

JC05 Rec'd 2002 29 MAR 2002

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 81833.0036
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NUMBER (if known, see 37 C.F.R. 1.12) 107089598 Not assigned
INTERNATIONAL APPLICATION NO. PCT/JP00/06756	INTERNATIONAL FILING DATE 29 September 2000	PRIORITY DATE CLAIMED 30 September 1999
TITLE OF INVENTION CONVEYING APPARATUS, INSPECTING APPARATUS AND ALIGNING AND SUPPLYING APPARATUS		
APPLICANT(S) FOR DO/EO/US Shogo KAKIUCHI and Koji TSUTSUMI		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ul style="list-style-type: none"> a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ul style="list-style-type: none"> a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)) 		
Items 11. to 16. below concern document(s) or information included:		
<ol style="list-style-type: none"> 11. <input type="checkbox"/> An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. 13. <input type="checkbox"/> A FIRST preliminary amendment. <ul style="list-style-type: none"> <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input type="checkbox"/> Other items or information: 		

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.6) 107089598 Not assigned	INTERNATIONAL APPLICATION NUMBER PCT/JP00/06756	ATTORNEY'S DOCKET NUMBER 81833.0036				
17. <input checked="" type="checkbox"/> The following fees are submitted: BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5)):		CALCULATIONS PTO USE ONLY				
Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO of JPO \$[1040] International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$[890] International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO \$[740] International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$[710] International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$[100]						
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$ 890.00				
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).		\$ 130.00				
CLAIMS	NUMBER FILED	NUMBER ALLOWED	NUMBER EXTRA	RATE		
Total claims	20	20	0	X \$18.00	0	
Independent claims	3	3	0	X \$84.00	0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				X \$280.00	\$ 0	
TOTAL OF ABOVE CALCULATIONS =					1020.00	
<input type="checkbox"/> Applicant claims small entity status. See 37 C.F.R. § 1.27. The fees indicated above are reduced by 1/2.					\$	
SUBTOTAL =					1020.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f)).					\$ 0	
TOTAL NATIONAL FEE =					0	
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31) \$40.00 per property +					\$ 0	
TOTAL FEES ENCLOSED =					1020.00	
					Amt. Refunded	\$
					Amt. charged	\$
\$ a. <input checked="" type="checkbox"/> Checks in the amounts of <u>\$1020.00</u> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. 50-1314 in the amount of <u>0</u> to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 50-1314. A duplicate copy of this sheet is enclosed.						
NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.						
SEND ALL CORRESPONDENCE TO: <input checked="" type="checkbox"/> Customer Number 000026021 →  HOGAN & HARTSON L.L.P. 500 South Grand Avenue, Suite 1900 Los Angeles, California 90071 Phone: 213-337-6700 Fax: 213-337-6701						
SIGNATURE <i>Lawrence J. McClure</i> REG.NO. 44,228 EL 713 627 098 US March 29, 2002						

Transmittal Letter to the United States Designated Office (DO/US)—Entry Into National Stage under 35 U.S.C. 371—PTO 1390 [13-7]

PTO/PCT Rec'd 01 JUL 2002

PATENT
81833.0036

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Art Unit: Not assigned

Shogo KAKIUCHI et al.

Examiner: Not assigned

Serial No.: 10/089,598

Filed: March 29, 2002

For: CONVEYING APPARATUS, INSPECTING APPARATUS
AND ALIGNING AND SUPPLYING APPARATUS**PRELIMINARY AMENDMENT**Box PCT
Assistant Commissioner for Patents
Washington, D.C. 20231

I hereby certify that this correspondence
is being deposited with the United States
Postal Service with sufficient postage as
first class mail in an envelope addressed
to:

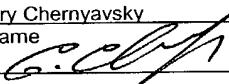
Commissioner for Patents
Washington D.C. 20231, on

June 25, 2002

Date of Deposit

Gary Chernyavsky

Name



6/25/02

Signature

Date

Dear Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

On page 1, line 1, please delete the heading "DESCRIPTION".

On page 1, after the title, insert the heading --BACKGROUND OF THE
INVENTION--.

Replace the paragraph on page 1, starting on line 5 with the following text:

The present invention relates to a conveying apparatus for an article to be inspected by an inspecting apparatus for small articles such as medicine in the form of tablets, capsules, etc., small confectionery such as a candy and the like, a washer, a battery cell, or the like, in a defect inspection process, a visual inspection process, a dimensional check process or the like.

Replace the paragraph on page 1, starting at line 14 with the following text:

When inspecting surfaces of articles such as the small articles conveyed using a conveying apparatus, a plurality of conveying apparatuses formed in a linear direction have been conventionally arranged in series so as to easily transfer the article from one conveying apparatus to another conveying apparatus. However, this requires a lot of space to accommodate the linear conveying apparatuses. Alternatively, when positioning the conveying apparatus in a vertical direction, the linear space required to accommodate the apparatus is reduced but the height required to accommodate the conveying apparatus increases. As such, a conveyed article held by suctioning sometimes vibrates more at higher elevations and this makes it difficult to properly inspect these articles.

Replace the paragraph on page 1, starting at line 23 with the following text:

Further, the linear conveying apparatus is designed with a pair of parallel belts on which the article is placed and suction device for holding the article in place. If the diameter of the belts increase and a small article is conveyed, the side surfaces of these articles cannot be properly inspected because the side surfaces are covered by the belts.

Replace the paragraph on page 2, starting at line 7 with the following text:

Further, another type of conveying apparatus is the conventional type rotary disc apparatus. The rotary disc apparatus includes a contact portion made of an aluminum metal or the like, which comes into contact with the article. The contact portion has a low coefficient of friction which causes the article to slip, whereby the conveying of the article is easily displaced by its own weight.

Replace the paragraph on page 2, starting at line 12 with the following text:

Further, this kind of structure (for example, Japanese Patent Application Laid-Open No. 61-212374) is provided with movable opposing plates. A slit is provided between the plates with the gap small enough to prevent the article from falling between the plates. A suctioning device having a rotary tube shaft concentrically pierced in an inner side of the movable opposing plates, communicates with an inner portion of the

rotary tube shaft and sucks air from the slit to an inner side of the movable opposing plates. However, since the rotary tube shaft is provided, the air is unnecessarily sucked from the slit corresponding to a portion requiring no suction.

Replace the paragraph on page 2, starting at line 23 with the following text:

Further, the conveyed article proceeds to the conveying apparatus, the aligning and supplying apparatus is used. The conventional aligning and supplying apparatus is structured such that the conveyed article supplied on a turn table is exposed to an aligning operation of an aligning guide together with a rotation of the turn table, and is gradually aligned along a peripheral wall. The conveyed article reaching a thickness gate from the aligning guide is sorted on the border of a predetermined thickness, and the conveyed article having a thickness equal to or less than the thickness passes through the thickness gate so as to reach a width guide. The conveyed article reaching the width guide is sorted on the border of a predetermined width, and the conveyed article having a width equal to or less than the width passes through the width guide so as to be fed out to the conveying apparatus.

Replace the paragraph on page 3, starting at line 16 with the following text:

Accordingly, the present invention provides a conveying apparatus which can execute a side surface inspection of a small article without requiring a lot of space, execute an inspection in a rotary disc apparatus and shut out an air in a portion requiring no suction.

Replace the paragraph on page 3, starting at line 20 with the following text:

Further, present invention provides an aligning and supplying apparatus which can improve the processing efficiency even with small articles having different widths and thicknesses.

On page 3, line 24, change the heading “DISCLOSURE OF THE INVENTION” to –SUMMARY OF THE INVENTION--.

Replace the paragraphs starting on page 3, line 25 through page 4, line 10 with the following text:

In accordance with a first aspect of the present invention, there is provided a conveying apparatus including a rotary disc portion having a pair of parallel plate members with a region defined there between. A gap is formed on one side of the region between the pair of parallel plate members. A first suctioning device is disposed on an outer surface of the pair of parallel plate members to secure an article on the outer peripheral surfaces of the pair of parallel plate members by extracting air from the gap. A linear conveying portion is provided having a pair of parallel conveying belts with a gap formed there between. The linear conveying portion being is in communication with the rotary disc portion to transfer the article from the rotary disc portion to the linear conveying portion.

Replace the paragraph on page 4, starting at line 11 with the following text:

In accordance with the conveying apparatus described in the first aspect of the present invention, since the apparatus includes the rotary disc portion and the linear conveying portion, it is possible to stably convey without requiring a lot of space even when the linear conveying portion is arranged horizontally, and further it is possible to execute a side surface inspection of the conveyed article conveyed in the rotary disc.

Replace the paragraph on page 5, starting at line 14 with the following text:

In accordance with the conveying apparatus described in the third aspect, in addition to the same effect as that of the second aspect, it is possible to inspect both the front and back surfaces of the conveyed article by the linear conveying portion.

Replace the paragraph on page 5, starting at line 18 with the following text:

In accordance with a fourth aspect of the present invention, there is provided a conveying apparatus as described in the third aspect, further includes an aligning and supplying apparatus for aligning the conveyed article so as to supply to the outer peripheral surface of the rotary disc portion in an opposite side to the first conveying portion of the rotary disc portion, and an air shutting device for closing the slit of the

peripheral surface portion other than the peripheral surface portion reaching the first conveying portion from the aligning and supplying apparatus in a rotational direction of the rotary disc portion.

Replace the paragraph on starting on page 5, line 27 with the following text:

In accordance with the conveying apparatus described in the fourth aspect, in addition to the same effect as that of the third aspect, it is possible to shut the air of the slit requiring no suction in the rotary disc. Accordingly, it is possible to save the amount of air suctioning, the capacity of air blower and the amount of energy used.

Replace the paragraphs on page 6, starting on line 5 and ending on line 16 with the following text:

In accordance with a fifth aspect of the present invention, there is provided an inspecting apparatus using the conveying apparatus described in the first aspect, the second aspect, the third aspect or the fourth aspect, including a side surface inspecting portion for inspecting a side surface of the conveyed article on the rotary disc portion; a front surface inspecting portion for inspecting the front surface of the conveyed article on the first conveying portion; a back surface inspecting portion for inspecting the back surface of the conveyed article on the second conveying portion; and a sorting portion for sorting the conveyed article in response to an inspected result.

Replace the paragraph on page 6, starting at line 17 with the following text:

In accordance with the inspecting apparatus described in the fifth aspect, in addition to the same effects as that of the first aspect, the second aspect, the third aspect or the fourth aspect, it is possible to inspect the side surface and both the front and back surfaces of the conveyed article, and it is possible to sort in response to an inspected result.

Replace the paragraphs starting on page 6, line 23 and ending on page 7, line 15 with the following text:

In accordance with a sixth aspect of the present invention, there is provided an

aligning and supplying apparatus for mounting a conveyed article having different thickness and width and capable of being stably mounted by setting a thickness direction or a width direction to a vertical direction, respectively, including a turn table in which a step portion having a predetermined height is provided along a peripheral edge of a mounting surface; a width guide crossing to the step portion in such a manner as to guide the conveyed article mounted on the mounting surface from a center side to an outer peripheral side due to a rotation of the turn table, having one end positioned at the center side of the turn table rather than the step portion and having another end protruding outward from the outer periphery of the step portion so as to be fixed; and a thickness gate arranged in an upper side of the conveyed article passing within the width guide on the turn table, and having a projection portion protruding toward the conveyed article so as to be capable of getting down the conveyed article in a high attitude on the step portion without getting down the conveyed article in a low attitude at a time when the conveyed article moving along the width guide due to the rotation of the turn table rides over the step portion.

Delete the paragraphs starting on page 8, line 15 through page 9, line 7.

One page 9, line 8, change the heading “BEST MODE FOR CARRYING OUT THE INVENTION” to –DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--.

Replace the paragraphs on page 9, starting on line 9 and end on line 24 with the following text:

A description will be given of an embodiment in accordance with the present invention with reference to Figs. 1 to 10. Fig. 1 shows an inspecting apparatus, which has a conveying apparatus 1, an inspection portion 2 and a sorting portion 3. The conveying apparatus 1 has an aligning and supplying apparatus 4, a rotary disc portion 5, a first conveying portion 6 and a second conveying portion 7. The first conveying portion 6 and the second conveying portion 7 form a linear conveying portion 8. The aligning and supplying apparatus 4 is structured such that a conveyed article 11, for example, a small article, in this case, a tablet revolves around a turn table 10. The

conveyed article 11 is aligned along a peripheral edge portion of the turn table 10 by an aligning guide (not shown). The article is linearly fed by a width guide 15 (mentioned below) arranged near the peripheral edge portion of the turn table 10 with a slight gap so as to be supplied to the rotary disc portion 5.

Replace the paragraph starting on page 9, line 25 with the following text:

The inspection portion 2 has two side surface inspecting portions 12 for individually inspecting both side surfaces of the conveyed article 11 on the rotary disc portion 5, a front surface inspecting portion 13 for inspecting a front surface of the conveyed article 11 on the first conveying portion 6, and a back surface inspecting portion 14 for inspecting a back surface of the conveyed article 11 appearing upside on the second conveying portion 7. For example, the inspection section 2 can be a light source illuminating the conveyed article 11 and a television camera picking up an image of the conveyed article 11 applied to each of the structures in the inspection portion 2 (for example, Japanese Patent Application Publication No. 6-088656).

Replace the paragraph on page 10, starting at line 10 with the following text:

The sorting portion 3 sorts the conveyed article 11 in response to data obtained from the inspection section 2. The data obtained from the inspecting portion 2 is fed to a control means, for example, an analyzer or the like, to be compared with reference data. An analysis for obtaining an acceptable article data or a defective article data is executed and the data is transmitted to the sorting portion 3. The time that the sorted article 11 arrives at the sorting portion 3 is taken by counting the conveyed article 11 passing through the inspection portion 2, and the conveyed article 11 is divided into an acceptable article collecting duct and a defective article collecting duct. The conveyed article 11 is sorted using a blowing device such as an air pressure device incorporated in the sorting portion 3 in response to the results obtained from the inspection portion 2.

Replace the paragraph starting on page 10, line 22 with the following text:

Fig. 2 shows a cross section of the rotary disc portion 5 having a suctioning device. The rotary disc portion 5 includes a pair of parallel rotating plates 20 and 21

having a region defined between them. A gap is formed on one side of the region between the plates and a slit 17 formed on the other side of the region between the plates members. A suctioning device 22 is disposed on an outer surface of at least one of the plates to secure the article 11 on the outer peripheral surfaces of the plates by extracting air from the groove. In the embodiment, the structure further includes a motor 18 and a drive shaft 19 of the motor 18 on which the parallel rotating plates 20 and 21 are mounted.

The parallel rotating plates 20 and 21 are opposing each other so that peripheral edges of the parallel rotating plates 20 and 21 are close to each other. The slit is formed between the plates, for example, using plate-like discs, and a fixed suction duct 22 is rotatably mounting the drive shaft 19 of the motor 18. The pair of parallel rotating plates 20 and 21 is mounted to a tubular connecting member 60 fitted to the drive shaft 19 so as to determine an interval of the slit 17.

A ring-like supporting member 23 having a high coefficient of friction is provided in both sides of the slit 17 along the outer peripheral surfaces of the parallel rotating plates 20 and 21. In the embodiment, a peripheral groove 24 is formed in each of the outer peripheral edges of the parallel rotating plates 20 and 21, wherein the supporting member 23 has a large friction coefficient. For example, an O-ring made of a material having an adhesive property and a buffering property, for example, rubber or the like is attached thereto, and an interval of the slit 17 between the O-rings is set to be smaller than a size of the conveyed article 11, for example, about 1 mm.

The suction duct 22 is mounted to the drive shaft 19 of the motor 18 via a bearing 25 which moves the suction duct 22 close to one rotating plate 21 so as to form a gap 30 at an interval t , for example, about 0.5 mm. Sucking holes 26 and 27 respectively communicating with opposing portions thereof. The suction duct 22 is provided with a sucking connection portion 28 on a side surface of the suction duct 22, and connects a known suction device (not shown) to the sucking connection portion 28. Accordingly, when taking out air within the suction duct 22 by operating the suction device, the space between a pair of parallel rotating plates 20 and 21 experience a negative pressure through the sucking holes 26 and 27. Thus, the air is sucked from the slit 17 between the rotating plates 20 and 21.

At this time, the gap 30 between the suction duct 22 and the rotating plate 21 achieves a seal effect due to a pressure loss of a fine interval. When mounting the conveyed article 11 such as the tablet or the like on the supporting member 23, the conveyed article 11 is held by suctioning of the conveyed article to the supporting member 23 due to an air pressure, and when the rotating plates 20 and 21 rotate in correspondence to the rotation of the motor 18, the conveyed article 11 moves around the circumference of the rotating plates 20 and 21 in connection with the rotation of the rotating plates 20 and 21. Accordingly, the conveyed article 11 is released from the rotary disc portion 5 by the aligning and supplying apparatus 4 as shown in Fig. 1. The article 11 then passes through side surface inspection portion 12 for inspection while being held by suction by the slit 17, and is conveyed toward the first conveying portion 6.

Replace the paragraph on page 12, starting at line 10 with the following text:

Reference numeral 32 denotes an air shutting device. The air shutting device 32 closes the slit 17 of the peripheral surface portion 33 other than a peripheral surface portion reaching the first conveying portion 6 from the aligning and supplying apparatus 4 in the rotational direction of the rotary disc portion 5. In the embodiment, a center portion thereof is supported to the drive shaft 19 of the motor 18 via the bearing 34 and a peripheral edge portion 35 is positioned so as to close the slit 17 of the peripheral surface portion 33.

Replace the paragraph starting on page 12, line 18 with the following text:

Fig. 3 shows an air shutting device 32. The air shutting device 32 is formed of a substantially meniscus-shaped disc 36 and a semicircular protruding portion 37 is provided in a center portion of a flat portion 36. The bearing 34 is provided in the protruding portion 37, and the bearing 34 is fitted to the drive shaft 19 of the motor 18, whereby the disc 36 is supported to the drive shaft 19. A wind guide 39 for obliquely guiding the air at a position of the slit 17 is provided at both ends of the flat portion 36a of the disc 36.

Further, a fixed plate receiving groove 40 is formed in a part of a circumferential portion of the disc 36. A pair of fixed pins 41 is provided within the fixed plate receiving

groove 40 in a standing manner. A front end of a fixed plate 45 having a thickness of about 0.5 mm is inserted and attached within the fixed plate receiving groove 40 between the fixed pins 41 through the slit 17. A long hole 46 longer in an inserting direction is formed at a rear end of the fixed plate 45. A fixing means inserted to the long hole 46, for example, a thumb screw 47 is fastened to one end of a fixed member 48. The fixed plate 45 is fixed to a vertical base 49 (Fig. 5) via the fixed member 48 so as to be adjustable. Accordingly, the air sucked by the suction device and moving forward from the slit 17 is limited to a portion of the rotating plates 20 and 21 where the disc 36 does not exist. In this case, one of the wind guides 39 faces the aligning and supplying apparatus 4.

Replace the paragraph on page 13, starting at line 14 with the following text:

Fig. 5 shows a state that another end of the fixed member 48 is mounted to the vertical base 49 to which the motor 18 is mounted, and the fixed plate 45 is fixed to one end of the fixed member 48 by the thumb screw 47. Reference numeral 50 denotes a fixing device for fixing the rotating plate 20 to the tubular connection member 60 (Fig. 2).

Replace the paragraphs starting on page 13, line 19 with the following text:

Fig. 6 is a front elevational view of the rotating plates 20 and 21. The linear conveying portion 8 including the suctioning device maintains the position of the conveyed article 11 riding over a pair of parallel conveying belts 52 through the gap between the conveying belts 52 as shown in Fig. 1, by extracting air thereby holding the conveyed article 11 by suction to the conveying belt 52. One end of the conveying belts 52 opposes the outer peripheral surface of the rotary disc portion 5 so as to transfer the conveyed article 11. This linear conveying portion 8, as shown in Fig. 1, includes the first conveying portion 6 and the second conveying portion 7 having the same structure, one end of the first conveying portion 6 opposes to another of the wind guide 39 on the outer peripheral surface of the rotary disc portion 5 so as to transfer the conveyed article 11, and one end of the second conveying portion 7 opposes to another end of the first conveying portion 6 so as to transfer the conveyed article 11.

Reference numerals 6a, 6b, 7a and 7b denote a ring body winding the conveying belt 52 there around, for example, a pulley or the like. The ring bodies 6a, 6b, 7a and 7b connect one of the first conveying portion 6 and the second conveying portion 7 to a rotation driving means. The known structure is applied to the linear conveying portion 8 (for example, Japanese Patent Application Publication No. 5-065405).

Replace the paragraph starting on page 14, line 16 with the following text:

Figs. 7 and 8 are views showing details of the aligning and supplying apparatus 4 (in this case, a rotational direction of the turn table 10 is set to be opposite to Fig. 1). The aligning and supplying apparatus 4 is structured, for example, such as aligning the conveyed article 11 having different thicknesses T and widths W (refer to Fig. 10) and capable of setting the thickness or the width of the conveyed article 11 in the vertical direction. For example, a tablet has a width of about 6 mm, a thickness of about 5 mm and a length longer than the width or the length. The aligning and supplying apparatus 4 includes turn table 10, width guide 15, a thickness gate 55, an aligning guide (not shown) and a peripheral wall (not shown). The turn table 10 is structured such that a sheet having a thickness of about 0.5 mm is adhered to its mounting surface 10a, and a step portion 56 having a predetermined height is provided along a peripheral edge of the mounting surface 10a. The step portion 56 is structured, as shown in Fig. 8, such that a sheet, for example, having a thickness of about 0.5 mm is adhered to an outer periphery.

Replace the paragraph on page 15, starting at line 12 with the following text:

The width guide 15 crosses to the step portion 56 so as to guide the conveyed article 11 mounted on the mounting surface 10a to the outer peripheral side from the center side due to the rotation of the turn table 10, for example, linearly, one end is positioned close to a center side of the turn table rather than the step portion 56, and another end protrudes outward from the outer periphery of the step portion 56 so as to be fixed (the fixing means is not shown). The width of the width guide 15 in accordance with the embodiment is set to a size capable of guiding the conveyed article 11 when the width and the thickness of the conveyed article 11 are set to the vertical direction, and the conveyed article 11 aligned by the aligning guide is introduced within the width guide 15.

Replace the paragraph starting on page 15, line 23 with the following text:

Figs. 9 and 10 illustrate an operation within the width guide 15 and the thickness gate 55. Figs. 9A and 10A show a cross section along a line A-A in Fig. 7, Figs. 9B and 10B show a cross section along a line B-B in Fig. 7, and Figs. 9C and 10C show a cross section along a line C-C in Fig. 7. The thickness gate 55 is arranged in an upper side of the conveyed article 11 passing within the width guide 15 on the turn table 10, and has a projection portion 57 protruding toward the conveyed article 11. The projection portion 57 along with step portion 56 are used to rotate the conveyed article 11 when the conveyed article 11 is positioned such that its width is oriented in the vertical direction. In the embodiment, the thickness gate 55 is set to a height at which the conveyed article 11 can enter within the width guide 15 even when the conveyed article is positioned such that its width is oriented in the vertical direction, and the projection portion 57 is provided in one side of the width guide 15, that is, an opposite side to a side from which the step portion 56 progressively enters, so as to protrude such a degree as to contact with a side surface at an upper end of the conveyed article 11, thereby rotating the conveyed article 11 such that its thickness is oriented in the vertical direction.

Replace the paragraph starting on page 16, line 14 with the following text:

Figs. 9A, 9B and 9C show a state in which the conveyed article 11 is positioned such that its width is oriented in the vertical direction, that is, the tablet is mounted on the turn table 10 by setting the width direction to the vertical direction, and Fig. 9A shows a state in which the conveyed article 11 is introduced within the thickness gate 55 and the width guide 15. Fig. 9B shows a state in which the step portion 56 moves forward to about half in the horizontal direction so as to press the side portion of the conveyed article 11 while the conveyed article 11 moves along one side wall of the width guide 15 due to the rotation of the turn table 10, whereby the upper end side surface of the conveyed article 11 is brought into contact with the projection portion 57 so as to be tilted. Fig. 9C shows a state in which the step portion 56 completely enters within the width guide 15. At this time, the conveyed article 11 sits on top of the step portion 56, and the conveyed article 11 rotates such that its thickness is set to the vertical direction.

Thereafter, as shown in Fig. 7, the conveyed article 11 further moves along the width guide 15, drops down from the peripheral edge portion of the turn table 10 and drops down on the slit 17 of the rotary disc portion 5 so as to be held by suction.

Replace the paragraph starting on page 17, line 6 with the following text:

Figs. 10A, 10B and 10C show a state in which the conveyed article 11 is positioned such that its thickness is oriented in the vertical direction, that is, the conveyed article 11 is mounted on the turn table 10 by setting the thickness direction to the vertical direction, and Fig. 10A shows a state in which the conveyed article 11 is introduced within the thickness gate 55 and the width guide 15. Fig. 10B shows a state in which the step portion 56 moves forward to about half in the horizontal direction so as to press the side portion in the mounting side of the conveyed article 11 while the conveyed article 11 moves along one side wall of the width guide 15 due to the rotation of the turn table 10, whereby the conveyed article 11 is going to sit on top of the step portion 56. At this time, since the conveyed article 11 has a size not being brought into contact with the side surface of the upper end portion of the conveyed article 11 as mentioned above, the conveyed article 11 is not tilted while being brought into contact with one side wall of the width guide 15, and even when it is going to be tilted, the upper end surface of the conveyed article 11 is brought into contact with the lower surface of the projection portion 57 so as to prevent the conveyed article 11 from being tilted. Fig. 10C shows a state in which the step portion 56 completely enters within the width guide 15. At this time, the conveyed article 11 sits on top of the step portion 56. The later operations are the same as those described in Fig. 9, and in any case, the conveyed article 11 drops down to the peripheral edge portion of the rotary disc portion so as to be held by suction by setting the thickness T to the vertical direction.

Replace the paragraph on page 18, starting at line 2 with the following text:

In accordance with this embodiment, since the apparatus includes the rotary disc portion 5 and the linear conveying portion 8, it is possible to stably convey with saving a space even when arranging the linear conveying portion 8 horizontally, and it is possible to execute the side surface inspection of the conveyed article 11 conveyed on the rotary

disc 5.

Replace the paragraph on page 18, starting at line 7 with the following text:

As is different from the conveying belt 52 of the linear conveying portion 8, since it is possible to fix the supporting member 23 to the peripheral edge of the rotary disc portion 5 and it is possible to reduce the cross sectional area of the supporting member 23, it is possible to stably inspect the conveyed article 11 without working against the side surface inspection of the conveyed article 11 and without slipping the conveyed article 11. In particular, when the supporting member 23 includes a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

Replace the paragraph on page 18, starting at line 18 with the following text:

It is possible to shut the air in the portion of the slit 17 requiring no suction in the rotary disc 5. Accordingly, it is possible to save the amount of air suctioning and the working capacity of the blower. Also, energy can be saved.

Replace the paragraph on page 18, starting at line 21 with the following text:

It is possible to inspect each of the side surfaces and both of the front and back surfaces of the conveyed article 11. It is also possible to sort the conveyed articles according to the results obtained from the inspection portions of the apparatus.

Replace the paragraph on page 18, starting at line 24 with the following text:

It is possible to align all the small articles having different widths W and thicknesses T and stabilizing under the turned state in the low attitude, and it is not necessary to sort, so that it is possible to improve a processing efficiency.

On page 19, line 1, delete the heading “INDUSTRIAL APPLICABILITY”.

Replace the paragraphs on page 1, starting at line 1 through line 18 with the following text:

In accordance with the conveying apparatus described in the first aspect of the present invention, since the apparatus includes a rotary disc portion and the linear conveying portion, it is possible to stably convey articles without requiring a lot of space even when the linear conveying portion is arranged horizontally. It is also possible to execute a side surface inspection of the conveyed article conveyed on the rotary disc. In accordance with the conveying apparatus described in the second aspect of the present invention, in addition to the same effects as that of the first aspect, it is possible to fix the supporting member to the peripheral edge of the rotary disc portion being different from the conveying belt in the linear conveying portion and it is possible to make a cross sectional area of the supporting member small, so that it is possible to stably inspect the conveyed article without working against the side surface inspection of the conveyed article and without slipping the conveyed article. In particular, when the supporting member includes a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

Replace the paragraph on page 19, starting at line 19 with the following text:
In accordance with the conveying apparatus described in the third aspect, in addition to the same effects as that of the second aspect, it is possible to inspect both the front and back surfaces of the conveyed article by the linear conveying portion.

Replace the paragraph starting on page 19, line 23 with the following text:
In accordance with the conveying apparatus described in the fourth aspect, in addition to the same effect as that of the third aspect, it is possible to shut the air of the slit requiring no suction in the rotary disc. Accordingly, it is possible to save the amount of air suctioning provided and blower capacity used as well as save energy.

Replace the paragraph on page 20, starting at line 2 with the following text:
In accordance with the inspecting apparatus described in the fifth aspect, in addition to the same effects as that of the first aspect, the second aspect, the third aspect or the fourth aspect, it is possible to inspect the side surface and both the front and back surfaces of the conveyed article, and it is possible to sort in response to the inspected

results.

Replace the paragraph on page 20, starting at line 8 with the following text:

In accordance with the aligning and supplying apparatus described in the sixth aspect, it is possible to align all the small articles having different widths and thicknesses and stabilizing under the turned state in a low attitude, and it is not necessary to sort, so that it is possible to improve the processing efficiency.

IN THE CLAIMS:

Please cancel claims 2-5 without prejudice to or disclaimer of the subject matter contained therein

Please replace the text of claim 1 with the following text:

1. A conveying apparatus comprising:

a rotary disc portion having a pair of parallel plate members with a region defined there between;

a gap formed on the region between the pair of parallel plate members;

a first suctioning device disposed to secure an article on the outer peripheral surfaces of the pair of parallel plate members by extracting air from the gap; and

a linear conveying portion having a pair of parallel conveying belts with a gap formed there between, the linear conveying portion being in communication with the rotary disc portion to transfer the article from the rotary disc portion to the linear conveying portion.

Please add new claims 7-24 as follows:

7. The conveying apparatus according to claim 1 comprising supporting members positioned in the pair of parallel plate members to hold the article in place such that the article transfers to the linear conveying portion.

8. The conveying apparatus according to claim 7, wherein the supporting members

have a large coefficient of friction.

9. The conveying apparatus according to claim 7, wherein the pair of parallel plate members includes grooves provided around the peripheral surface of each of the parallel plate members.

10. The conveying apparatus according to claim 7, wherein the supporting members are made of rubber.

11. The conveying apparatus according to claim 1 further comprising a second suctioning device provided between the pair of parallel conveying belts.

12. The conveying apparatus according to claim 1 further comprising a side surface inspection portion for inspecting a side surface of the article.

13. The conveying apparatus according to claim 1, wherein the linear conveying portion includes a first conveying portion and a second conveying portion, one end of the first conveying portion in communication with the outer peripheral surfaces of the pair of parallel plate members so as to transfers the article, and one end of the second conveying portion in communication with the other end of the first conveying portion so as to further transfer the article.

14. The conveying apparatus according to claim 13 further comprising an aligning and supplying apparatus which aligns the article and supplies the article to the outer peripheral surfaces of the pair of parallel plate members,

the aligning and supplying apparatus being positioned opposite the first conveying portion,

wherein the rotary disc portion is disposed between the aligning and supplying apparatus and the first conveying portion.

15. The conveying apparatus according to claim 14, wherein the aligning and

supplying apparatus includes a turntable and a width guide.

16. The conveying apparatus according to claim 1 further comprising an air shutting device positioned between the pair of parallel plate members and forming the slit, the air shutting device having a solid portion for preventing air suctioning.
17. The conveying apparatus according to claim 13 further comprising:
 - a front surface inspection portion for inspecting a front surface of the article conveyed on the first conveying portion;
 - a back surface inspection portion for inspecting a back surface of the article conveyed on the second conveying portion; and
 - a sorting portion for sorting the article.
18. The conveying apparatus according to claim 17, wherein the article is sorted in response to results obtained from the front surface inspection portion, the back surface inspection portion or the side surface inspection portion.
19. A method for conveying an article comprising:
 - providing an article on a rotary disc portion having a pair of parallel plate members with a region defined there between, with a gap formed on one side of the region between the pair of parallel plate members;
 - securing the article on outer peripheral surfaces of the pair of parallel plate members by extracting air from the gap; and
 - guiding the article onto a linear conveying portion having a pair of parallel conveying belts with a gap formed there between, the linear conveying portion being in communication with the rotary disc portion to transfer the article from the rotary disc portion to the linear conveying portion.
20. The method for conveying according to claim 19 further comprising providing grooves provided around the peripheral surface of each of the parallel plate members.

21. The method for conveying according to claim 20 further comprising positioning supporting members in the grooves of the pair of parallel plate members to hold the article in place such that the article transfers to the linear conveying portion.

22. The method for conveying according to claim 19 further comprising inspecting a side surface of the article

23. The method for conveying according to claim 19 further comprising aligning and supplying the article to the outer peripheral surfaces of the pair of parallel plate members.

24. The method for conveying according to claim 19 further comprising:
inspecting a front surface of the article conveyed;
inspecting a back surface of the article conveyed; and
sorting the article.

REMARKS

Claims 1, 6 and 7-24 are presently in this application for consideration. The amendments are made to place the present application in better form and in condition for allowance. No new matter has been added. Entry and consideration of these amendments prior to the first Office Action are respectfully requested.

Respectfully submitted,
HOGAN & HARTSON, L.L.P

By: 
Anthony J. Orlin
Registration No. 41,232
Attorney for Applicants

Date: June 25, 2002

Biltmore Tower, Suite 1900
500 South Grand Avenue
Los Angeles, California 90071
Phone: 213 337-6700
Fax: 213 337-6701

Versions with markings to show the changes made:

IN THE SPECIFICATION:

Please amend the paragraph on page 1, starting on line 5 as follows:

The present invention relates to a conveying apparatus for [a conveyed] an article [inspecting apparatus for inspecting mainly a small article such as a drug medicine (a tablet, a capsule and the like),] to be inspected by an inspecting apparatus for small articles such as medicine in the form of tablets, capsules, etc., small confectionery such as a candy and the like, a washer, a [button electric cell] battery cell, or the like, [as the conveyed article] in a defect inspection [step] process, a visual inspection [step] process, a dimensional check [step] process or the like [of the conveyed article while conveying the conveyed article, an inspecting apparatus thereof and an aligning and supplying apparatus thereof].

Please amend the paragraph on page 1, starting at line 14 as follows:

[In the case of detecting respective surfaces of the conveyed article] When inspecting surfaces of articles such as the small [article or the like while conveying] articles conveyed using a conveying apparatus, a plurality of [linear] conveying apparatuses formed in a linear direction have been conventionally arranged in series [connection] so as to [be capable of transferring, however, there has been a disadvantage that a wide space to be occupied is required] easily transfer the article from one conveying apparatus to another conveying apparatus. However, this requires a lot of space to accommodate the linear conveying apparatuses. [On the contrary] Alternatively, when [placing] positioning the conveying apparatus in a vertical [attitude] direction, the [occupied] linear space required [is reduced, however, a required height thereof is significantly increased, and since the conveyed article held by suction is sometimes inclined to vibration of the conveying process or an its own weight, it is hard to inspect] to accommodate the apparatus is reduced but the height required to accommodate the conveying apparatus increases. As such, a conveyed article held by suctioning sometimes vibrates more a higher elevations and this makes it difficult to properly inspect these articles.

Please amend the paragraph on page 1, starting at line 23 as follows:

Further, the linear conveying apparatus [for conveying the conveyed article in a linear direction is structured, for example, such that the conveyed article is mounted so as to ride] is designed with a pair of parallel belts [and is conveyed while being held by suction by a suction means through a gap between the belts, so the since the belts can not be elongated and narrowed in order to resist a tensile strength, in the case that the conveyed article mounted on the belts is a small article, side surfaces thereof are supported between the belts deeply and the side surface of the conveyed article can not be sufficiently inspected] on which the article is placed and suction device for holding the article in place. If the diameter of the belts increase and a small article is conveyed, the side surfaces of these articles cannot be properly inspected because the side surfaces are covered by the belts.

Please amend the paragraph on page 2, starting at line 7 as follows:

Further, [since a conventional rotary disc is structured such that a contact portion with the conveyed article is made, for example, of aluminum metal or the like, the contact portion easily slipped due to a low coefficient of friction, whereby a conveyed state is easily changed due to a weight of the conveyed article] another type of conveying apparatus is the conventional type rotary disc apparatus. The rotary disc apparatus includes a contact portion made of an aluminum metal or the like, which comes into contact with the article. The contact portion has a low coefficient of friction which causes the article to slip, whereby the conveying of the article is easily displaced by its own weight.

Please amend the paragraph on page 2, starting at line 12 as follows:

Further, [the structure of this kind of rotary disc apparatus] this kind of structure (for example, Japanese Patent Application Laid-Open No. 61-212374) is provided with movable opposing plates [constituted by a pair of mutually opposing rotary disc having a slit which is provided in peripheral portions of the rotary discs and continuously all around the periphery thereof and has an opposing gap smaller than the small article, and a

suction means]. A slit is provided between the plates with the gap small enough to prevent the article from falling between the plates. A suctioning device having a rotary tube shaft concentrically pierced in an inner side of the movable opposing plates, [communicating] communicates with an inner portion of the rotary tube shaft and [sucking] sucks air from the slit to an inner side of the movable opposing plates.
However, since the rotary tube shaft is provided, the air is unnecessarily sucked from the slit corresponding to a portion requiring no suction.

Please amend the paragraph on page 2, starting at line 23 as follows:

Further, [in the case of supplying the conveyed article] the conveyed article proceeds to the conveying apparatus, the aligning and supplying apparatus is used. The conventional aligning and supplying apparatus is structured such that the conveyed article supplied on a turn table is exposed to an aligning operation of an aligning guide together with a rotation of the turn table, and is gradually aligned along a peripheral wall. The conveyed article reaching a thickness gate from the aligning guide is sorted on the border of a predetermined thickness, and the conveyed article having a thickness equal to or less than the thickness passes through the thickness gate so as to reach a width guide. The conveyed article reaching the width guide is sorted on the border of a predetermined width, and the conveyed article having a width equal to or less than the width passes through the width guide so as to be fed out to the conveying apparatus.

Please amend the paragraph on page 3, starting at line 16 as follows:

Accordingly, [an object of] the present invention provides [is to provide] a conveying apparatus which can execute a side surface inspection of a small article without requiring a lot of space, [stably] execute an inspection in a rotary disc apparatus and shut out an air in a portion requiring no suction.

Please amend the paragraph on page 3, starting at line 20 as follows:

Further, [another object of] the present invention [is to provide] provides an aligning and supplying apparatus which can improve the processing efficiency even [in a]

with small articles [in a small article] having different widths and thicknesses [width and thickness and being stable in a turned state].

Please amend the paragraphs starting on page 3, line 25 through page 4, line 10 as follows:

In accordance with a first aspect of the present invention, there is provided a conveying apparatus [comprising:

a rotary disc portion with a suction means which forms a slit on an outer peripheral surface and sucks through the slit so as to convey a conveyed article in a state of holding the conveyed article by suction to both sides of the slits; and

a liner conveying portion with a suction means which sucks the conveyed article riding over a pair of parallel conveying belts through a gap between the conveying belts so as to convey the conveyed article in a state of holding the conveyed article by suction to the conveying belt, and has one end opposing to the outer peripheral surface of the rotary disc portion so as to be capable of transfer the conveyed article]

including a rotary disc portion having a pair of parallel plate members with a region defined there between. A gap is formed on one side of the region between the pair of parallel plate members. A first suctioning device is disposed on an outer surface of the pair of parallel plate members to secure an article on the outer peripheral surfaces of the pair of parallel plate members by extracting air from the gap. A linear conveying portion is provided having a pair of parallel conveying belts with a gap formed there between. The linear conveying portion is in communication with the rotary disc portion to transfer the article from the rotary disc portion to the linear conveying portion.

Please amend the paragraph on page 4, starting at line 11 as follows:

In accordance with the conveying apparatus described in the first aspect of the present invention, since the apparatus [is constituted by] includes the rotary disc portion and the linear conveying portion, it is possible to stably convey without requiring a lot of space even when the linear conveying portion is arranged horizontally, and further it is possible to execute a side surface inspection of the conveyed article conveyed in the rotary disc.

Please amend the paragraph on page 5, starting at line 14 as follows:

In accordance with the conveying apparatus described in the third aspect, in addition to the same effect as that of the second aspect, it is possible to inspect both [of] the front and back surfaces of the conveyed article by the linear conveying portion.

Please amend the paragraph on page 5, starting at line 18 as follows:

In accordance with a fourth aspect of the present invention, there is provided a conveying apparatus as described in the third aspect, further [comprising] including an aligning and supplying apparatus for aligning the conveyed article so as to supply to the outer peripheral surface of the rotary disc portion in an opposite side to the first conveying portion of the rotary disc portion, and an air shutting [means] device for closing the slit of the peripheral surface portion other than the peripheral surface portion reaching the first conveying portion from the aligning and supplying apparatus in a rotational direction of the rotary disc portion.

Please amend the paragraph on starting on page 5, line 27 as follows:

In accordance with the conveying apparatus described in the fourth aspect, in addition to the same effect as that of the third aspect, it is possible to shut the air of the slit requiring no suction in the rotary disc. Accordingly, it is possible to save [a suction air amount] the amount of air suctioning, [a blower capacity can have a margin and an energy can be saved] the capacity of air blower and the amount of energy used.

Please amend the paragraphs on page 6, starting on line 5 and ending on line 16 as follows:

In accordance with a fifth aspect of the present invention, there is provided an inspecting apparatus using the conveying apparatus described in the first aspect, the second aspect, the third aspect or the fourth aspect, [comprising:] including a side surface inspecting portion for inspecting a side surface of the conveyed article on the rotary disc portion; a front surface inspecting portion for inspecting [a] the front surface of the conveyed article on the first conveying portion; a back surface inspecting portion for

inspecting [a] the back surface of the conveyed article on the second conveying portion;
and a sorting portion for sorting the conveyed article in response to an inspected result.

Please amend the paragraph on page 6, starting at line 17 as follows:

In accordance with the inspecting apparatus described in the fifth aspect, in addition to the same effects as that of the first aspect, the second aspect, the third aspect or the fourth aspect, it is possible to inspect [respective surfaces comprising] the side surface and both the [surfaces of the] front and back surfaces of the conveyed article, and it is possible to sort in response to an inspected result [in the sorting portion].

Please amend the paragraphs starting on page 6, line 23 and ending on page 7, line 15 as follows:

In accordance with a sixth aspect of the present invention, there is provided an aligning and supplying apparatus for mounting a conveyed article having different thickness and width and capable of being stably mounted by setting a thickness direction or a width direction to a vertical direction, respectively, [comprising:] including a turn table in which a step portion having a predetermined height is provided along a peripheral edge of a mounting surface; a width guide crossing to the step portion in such a manner as to guide the conveyed article mounted on the mounting surface from a center side to an outer peripheral side due to a rotation of the turn table, having one end positioned at the center side of the turn table rather than the step portion and having another end protruding outward from the outer periphery of the step portion so as to be fixed; and a thickness gate arranged in an upper side of the conveyed article passing within the width guide on the turn table, and having a projection portion protruding toward the conveyed article so as to be capable of getting down the conveyed article in a high attitude on the step portion without getting down the conveyed article in a low attitude at a time when the conveyed article moving along the width guide due to the rotation of the turn table rides over the step portion.

Please amend the paragraphs on page 9, starting on line 9 and end on line 24 as follows:

A description will be given of an embodiment in accordance with the present invention with reference to Figs. 1 to 10. Fig. 1 shows an inspecting apparatus, which has a conveying apparatus 1, an inspection portion 2 and a sorting portion 3. [A] The conveying apparatus 1 has an aligning and supplying apparatus 4, a rotary disc portion 5, a first conveying portion 6 and a second conveying portion 7. The first conveying portion 6 and the second conveying portion 7 [constitute] form a linear conveying portion 8. The aligning and supplying apparatus 4 is structured such that a conveyed article 11, for example, a small article, in this case [particularly], a tablet [is mounted on] revolves around a turn table 10 [, and] . The conveyed article 11 is aligned along a peripheral edge portion [in correspondence to a rotation] of the turn table 10 by an aligning guide (not shown) [arranged over the turn table 10 with a slight gap and]. The article is linearly fed by a width guide 15 (mentioned below) arranged near the peripheral edge portion of the turn table 10 with a slight gap so as to be supplied to the rotary disc portion 5.

Please amend the paragraph starting on page 9, line 25 as follows:

The [inspecting] inspection portion 2 has two side surface inspecting portions 12 for individually inspecting both side surfaces of the conveyed article 11 on the rotary disc portion 5 [one side by side], a front surface inspecting portion 13 for inspecting a front surface of the conveyed article 11 on the first conveying portion 6, and a back surface inspecting portion 14 for inspecting a back surface of the conveyed article 11 appearing upside on the second conveying portion 7. For example, [a known structure provided with] the inspection section 2 can be a light source illuminating the conveyed article 11 and a television camera picking up an image of the conveyed article 11 [is] applied to each of the structures in the inspection portion 2 (for example, Japanese Patent Application Publication No. 6-088656).

Please amend the paragraph on page 10, starting at line 10 as follows:

The sorting portion 3 sorts the conveyed article 11 in response to [an inspected result.] data obtained from the inspection section 2. The data obtained [in] from the

inspecting portion 2 is fed to a control means, for example, an analyzer or the like [so as] , to be compared with reference data [,]. An analysis for obtaining an acceptable article data or a defective article data is executed[,] and the data is transmitted to the sorting portion 3[,]. [a timing] The time that the sorted [portion] article 11 [comes to] arrives at the sorting portion 3 is taken by counting the conveyed article 11 passing through the [inspecting] inspection portion 2, and the conveyed article 11 is divided into an acceptable article collecting duct and a defective article collecting duct [due to a blowing such as an air pressure in the sorting portion 3 in response to the inspected result, whereby the sorting operation is executed. The known structure is employed for the structure of the sorting portion 3]. The conveyed article 11 is sorted using a blowing device such as an air pressure device incorporated in the sorting portion 3 in response to the results obtained from the inspection portion 2.

Please amend the paragraph starting on page 10, line 22 as follows:

Fig. 2 shows a cross section of the rotary disc portion 5 [with the suction means. A slit 17 is formed on an outer peripheral surface of the rotary disc portion 5, and the conveyed article 11 is conveyed in a state of being held by suction to both sides of the slit 17 by sucking through the slit 17. In the embodiment, the] having a suctioning device. The rotary disc portion 5 includes a pair of parallel rotating plates 20 and 21 having a region defined between them. A gap is formed on one side of the region between the plates and a slit 17 formed on the other side of the region between [structure has a motor 18, a pair of rotating discs 20 and 21 mounted to a drive shaft 19 of the motor 18, opposing to each other so that peripheral edges are close to each other and forming the slit 17 therebetween, for example, using plate like discs, and a fixed suction duct 22 rotatably mounting the drive shaft 19 of the motor 18. A pair of rotary discs 20 and 21 are mounted to a tubular connecting member 60 fitted to the drive shaft 19 so as to determine an interval of the slit 17. A ring like supporting member 23 having a high friction coefficient is provided in both sides of the slit 17 along the outer peripheral surfaces of the rotary discs 20 and 21. In the embodiment, a peripheral groove 24 is formed in each of the outer peripheral edges of the rotary discs 20 and 21, the supporting member 23 having a large friction coefficient, for example, an O-ring made of a article

having an adhesive property and a buffering property, for example, a rubber or the like is attached thereto, and an interval of the slit 17 between the O-rings is set to be smaller than a size of the conveyed article 11, for example, about 1 mm. The suction duct 22 is mounted to the drive shaft 19 of the motor 18 via a bearing 25, moves the suction duct 22 close to one rotary disc 21 so as to form a gap 30 at an interval t , for example, about 0.5 mm, forms sucking holes 26 and 27 respectively communicating with opposing portions thereof, is provided with a sucking connection portion 28 on a side surface of the suction duct 22, and connects a known suction means (not shown) to the sucking connection portion 28. Accordingly, when taking out an air within the suction duct 22 by operating the suction means, a space between a pair of rotary discs 20 and 21 becomes negative pressure through the sucking holes 26 and 27, whereby the air is sucked from the slit 17 between the rotary discs 20 and 21. At this time, the gap 30 between the suction duct 22 and the rotary disc 21 achieves a seal effect due to a pressure loss of a fine interval.

When a mounting the conveyed article 11 such as the tablet or the like on the supporting member 23, the conveyed article 11 is held by suction to the supporting member 23 due to an air pressure, and when the rotary discs 20 and 21 rotate in correspondence to the rotation of the motor 18, the conveyed article 11 moves around a circumference of the rotary discs 20 and 21 in connection with the rotation of the rotary discs 20 and 21.

Accordingly, the conveyed article 11 dropped down to the rotary disc portion 5 from the aligning and supplying means 4 as shown in Fig. 1 passes through the side surface] the plates members. A suctioning device 22 is disposed on an outer surface of at least one of the plates to secure the article 11 on the outer peripheral surfaces of the plates by extracting air from the groove. In the embodiment, the structure further includes a motor 18 and a drive shaft 19 of the motor 18 on which the parallel rotating plates 20 and 21 are mounted.

The parallel rotating plates 20 and 21 are opposing each other so that peripheral edges of the parallel rotating plates 20 and 21 are close to each other. The slit is formed between the plates, for example, using plate-like discs, and a fixed suction duct 22 is rotatably mounting the drive shaft 19 of the motor 18. The pair of parallel rotating plates 20 and 21 is mounted to a tubular connecting member 60 fitted to the drive shaft 19 so as to determine an interval of the slit 17.

A ring-like supporting member 23 having a high coefficient of friction is provided in both sides of the slit 17 along the outer peripheral surfaces of the parallel rotating plates 20 and 21. In the embodiment, a peripheral groove 24 is formed in each of the outer peripheral edges of the parallel rotating plates 20 and 21, wherein the supporting member 23 has a large friction coefficient. For example, an O-ring made of a material having an adhesive property and a buffering property, for example, rubber or the like is attached thereto, and an interval of the slit 17 between the O-rings is set to be smaller than a size of the conveyed article 11, for example, about 1 mm.

The suction duct 22 is mounted to the drive shaft 19 of the motor 18 via a bearing 25 which moves the suction duct 22 close to one rotating plate 21 so as to form a gap 30 at an interval t , for example, about 0.5 mm. Sucking holes 26 and 27 respectively communicating with opposing portions thereof. The suction duct 22 is provided with a sucking connection portion 28 on a side surface of the suction duct 22, and connects a known suction device (not shown) to the sucking connection portion 28. Accordingly, when taking out air within the suction duct 22 by operating the suction device, the space between a pair of parallel rotating plates 20 and 21 experience a negative pressure through the sucking holes 26 and 27. Thus, the air is sucked from the slit 17 between the rotating plates 20 and 21.

At this time, the gap 30 between the suction duct 22 and the rotating plate 21 achieves a seal effect due to a pressure loss of a fine interval. When mounting the conveyed article 11 such as the tablet or the like on the supporting member 23, the conveyed article 11 is held by suctioning of the conveyed article to the supporting member 23 due to an air pressure, and when the rotating plates 20 and 21 rotate in correspondence to the rotation of the motor 18, the conveyed article 11 moves around the circumference of the rotating plates 20 and 21 in connection with the rotation of the rotating plates 20 and 21. Accordingly, the conveyed article [inspecting portion 12 so as to be applied to the side surface] 11 is released from the rotary disc portion 5 by the aligning and supplying apparatus 4 as shown in Fig. 1. The article 11 then passes through side surface inspection portion 12 for inspection while being held by suction by the slit 17, and is conveyed toward the first conveying portion 6.

Please amend the paragraph on page 12, starting at line 10 as follows:

Reference numeral 32 denotes an air shutting [means] device. The air shutting [means] device 32 closes the slit 17 of the peripheral surface portion 33 other than a peripheral surface portion reaching the first conveying portion 6 from the aligning and supplying apparatus 4 in the rotational direction of the rotary disc portion 5. In the embodiment, a center portion thereof is supported to the drive shaft 19 of the motor 18 via the bearing 34 and a peripheral edge portion 35 is positioned so as to close the slit 17 of the peripheral surface portion 33.

Please amend the paragraph starting on page 12, line 18 as follows:

Fig. 3 shows an air shutting [means] device 32. The air shutting [means] device 32 is [constituted by] formed of a substantially meniscus-shaped disc 36[,] and a semicircular protruding portion 37 is provided in a center portion of a flat portion 36 [, the]. The bearing 34 is provided in the protruding portion 37, and the bearing 34 is fitted to the drive shaft 19 of the motor 18, whereby the disc 36 is supported to the drive shaft 19. A wind guide 39 for obliquely guiding [a wind] the air at a position of the slit 17 is provided at both ends of the flat portion 36a of the disc 36.

Further, a fixed plate receiving groove 40 is formed in a part of a circumferential portion of the disc 36 [, a]. A pair of fixed pins 41 [are] is provided within the fixed plate receiving groove 40 in a standing manner [, a] . A front end of a fixed plate 45 having a thickness of about 0.5 mm is inserted and attached within the fixed plate receiving groove 40 between the fixed pins 41 through the slit 17 [, a]. A long hole 46 longer in an inserting direction is formed at a rear end of the fixed plate 45 [, a] . A fixing means inserted to the long hole 46, for example, a thumb screw 47 is fastened to one end of a fixed member 48 [, and] . The fixed plate 45 is fixed to a vertical base 49 (Fig. 5) via the fixed member 48 so as to be [capable of adjusting] adjustable. Accordingly, the air sucked by the suction [means] device and moving forward from the slit 17 is limited to a portion of the [rotary discs] rotating plates 20 and 21 where the disc 36 does not exist. In this case, one of the wind [guide] guides 39 faces [to] the aligning and supplying [means] apparatus 4.

Please amend the paragraph on page 13, starting at line 14 as follows:

Fig. 5 shows a state that another end of the fixed member 48 is mounted to the vertical base 49 to which the motor 18 is mounted, and the fixed plate 45 is fixed to one end of the fixed member 48 by the thumb screw 47. Reference numeral 50 denotes a fixing device for fixing the [rotary disc] rotating plate 20 to the tubular connection member 60 (Fig. 2).

Please amend the paragraphs starting on page 13, line 19 as follows:

Fig. 6 is a front elevational view of the [rotary discs] rotating plates 20 and 21. The linear conveying portion 8 [with] including the [suction means sucks] suctioning device maintains the position of the conveyed article 11 riding over a pair of parallel conveying belts 52 through the gap between the conveying belts 52 as shown in Fig. 1, by extracting air thereby holding the conveyed article 11 by suction to the conveying belt 52 [so as to convey, in which]. One end of the conveying belts 52 opposes the outer peripheral surface of the rotary disc portion 5 so as to [be capable of transferring] transfer the conveyed article 11. This linear conveying portion 8 [is], as shown in Fig. 1, [constituted by] includes the first conveying portion 6 and the second conveying portion 7 having the same structure, one end of the first conveying portion 6 opposes to another of the wind guide 39 on the outer peripheral surface of the rotary disc portion 5 so as to [be capable of transferring] transfer the conveyed article 11, and one end of the second conveying portion 7 opposes to another end of the first conveying portion 6 so as to [be capable of transferring] transfer the conveyed article 11.

Reference numerals 6a, 6b, 7a and 7b denote a ring body winding the conveying belt 52 there around, for example, a pulley or the like. The ring bodies 6a, 6b, 7a and 7b connect one of the first conveying portion 6 and the second conveying portion 7 to a rotation driving means. The known structure is applied to the linear conveying portion 8 (for example, Japanese Patent Application Publication No. 5-065405).

Please amend the paragraph starting on page 14, line 16 as follows:

Figs. 7 and 8 are views showing details of the aligning and supplying apparatus 4 (in this case, a rotational direction of the turn table 10 is set to be opposite to Fig. 1). The

aligning the conveyed article 11 having different thicknesses T and widths W (refer to Fig. 10) and capable of [being stably mounted in a state of] setting [a] the thickness or the width of the conveyed article 11 in the vertical direction [or a width direction to a vertical direction]. For example, [this is] a tablet [in which] has a width [is] of about 6 mm, a thickness [is] of about 5 mm and a length [is] longer than [these] the width or the length. The aligning and supplying apparatus 4 [has a] includes turn table 10, width guide 15, a thickness gate 55, an aligning guide (not shown) and a peripheral wall (not shown). The turn table 10 is structured such that a sheet having a thickness of about 0.5 mm is adhered to [a] its mounting surface 10a, and a step portion 56 having a predetermined height is provided along a peripheral edge of the mounting surface 10a. The step portion 56 is structured, as shown in Fig. 8, such that a sheet, for example, having a thickness of about 0.5 mm is adhered to an outer periphery.

Please amend the paragraph on page 15, starting at line 12 as follows:

The width guide 15 crosses to the step portion 56 so as to guide the conveyed article 11 mounted on the mounting surface 10a to the outer peripheral side from the center side due to the rotation of the turn table 10, for example, linearly, one end is positioned close to a center side of the turn table rather than the step portion 56, and another end protrudes outward from the outer periphery of the step portion 56 so as to be fixed (the fixing means is not shown). [A] The width of the width guide 15 in accordance with the embodiment is set to a size capable of guiding the conveyed article 11 [whichever] when the width [direction] and the thickness [direction is] of the conveyed article 11 are set to the vertical direction, and the conveyed article 11 aligned by the aligning guide is introduced within the width guide 15.

Please amend the paragraph starting on page 15, line 23 as follows:

Figs. 9 and 10 [describe] illustrate an operation within the width guide 15 and the thickness gate 55. Figs. 9A and 10A show a cross section along a line A-A in Fig. 7, Figs. 9B and 10B show a cross section along a line B-B in Fig. 7, and Figs. 9C and 10C show a cross section along a line C-C in Fig. 7. The thickness gate 55 is arranged in an

upper side of the conveyed article 11 passing within the width guide 15 on the turn table 10, and has a projection portion 57 protruding toward the conveyed article [11 so as to be capable of getting down the conveyed article 11 in a low attitude at a time] 11. The projection portion 57 along with step portion 56 are used to rotate the conveyed article 11 when the conveyed article 11 is positioned such [moving along the width guide 15 due to the rotation of the turn table 10 rides over the step portion 56.] that its width is oriented in the vertical direction. In the embodiment, the thickness gate 55 is set to a height at which the conveyed article 11 can enter within the width guide 15 even [in the high attitude,] when the conveyed article is positioned such that its width is oriented in the vertical direction, and the projection portion 57 is provided in one side of the width guide 15, that is, an opposite side to a side from which the step portion 56 progressively enters, so as to protrude such a degree as to contact with a side surface at an upper end of the conveyed article [11 in the high attitude, thereby getting down] 11, thereby rotating the conveyed article 11 such that its thickness is oriented in the vertical direction.

Please amend the paragraph starting on page 16, line 14 as follows:

Figs. 9A, 9B and 9C show a state in which the conveyed article 11 [in the high attitude] is positioned such that its width is oriented in the vertical direction, that is, the tablet is mounted on the turn table 10 by setting the width direction to the vertical direction, and Fig. 9A shows a state in which the conveyed article 11 is introduced within the thickness gate 55 and the width guide 15. Fig. 9B shows a state in which the step portion 56 moves forward to about half in the [width] horizontal direction so as to press the side portion [in the mounting side] of the conveyed article 11 while the conveyed article 11 moves along one side wall of the width guide 15 due to the rotation of the turn table 10, whereby the upper end side surface of the conveyed article 11 is brought into contact with the projection portion 57 so as to be tilted [in a get-down attitude]. Fig. 9C shows a state in which the step portion 56 completely enters within the width guide 15. At this time, the conveyed article 11 [rides over] sits on top of the step portion 56, and the conveyed article 11 [simultaneously gets down on the step portion 56 so as to become in the low attitude in which the thickness direction is set to the vertical direction.] rotates such that its thickness is set to the vertical direction. Thereafter, as shown in Fig. 7, the

conveyed article 11 further moves along the width guide 15, drops down from the peripheral edge portion of the turn table 10 and drops down on the slit 17 of the rotary disc portion 5 so as to be held by suction.

Please amend the paragraph starting on page 17, line 6 as follows:

Figs. 10A, 10B and 10C show a state in which the conveyed article 11 [in the low attitude] is positioned such that its thickness is oriented in the vertical direction, that is, the conveyed article 11 is mounted on the turn table 10 by setting the thickness direction to the vertical direction, and Fig. 10A shows a state in which the conveyed article 11 is introduced within the thickness gate 55 and the width guide 15. Fig. 10B shows a state in which the step portion 56 moves forward to about half in the [width] horizontal direction so as to press the side portion in the mounting side of the conveyed article 11 while the conveyed article 11 moves along one side wall of the width guide 15 due to the rotation of the turn table 10, whereby the conveyed article 11 is going to [ride over] sit on top of the step portion 56. At this time, since the [projection portion 57 has a size not being brought into contact with the side surface of the upper end portion of the] conveyed article 11 has a size not being brought into contact with the side surface of the upper end portion of the conveyed article 11 as mentioned above, [the projection portion 57 is not tilted while being brought into contact with one side wall of the width guide 15, and even when it is going to be tilted, the upper end surface of] the conveyed article 11 is not tilted while being brought into contact with one side wall of the width guide 15, and even when it is going to be tilted, the upper end surface of the conveyed article 11 is brought into contact with the lower surface of the projection portion 57 so as to prevent [projection portion 57] the conveyed article 11 from being tilted. Fig. 10C shows a state in which the step portion 56 completely enters within the width guide 15. At this time, the conveyed article 11 [rides over] sits on top of the step portion 56. The later operations are the same as those described in Fig. 9, and in any case, the conveyed article 11 drops down to the peripheral edge portion of the rotary disc portion so as to be held by suction by setting the thickness T [direction] to the vertical direction.

Please amend the paragraph on page 18, starting at line 2 as follows:

In accordance with this embodiment, since the apparatus [is constituted by] includes the rotary disc portion 5 and the linear conveying portion 8, it is possible to stably convey with saving a space even when arranging the linear conveying portion 8 horizontally, and it is possible to execute the side surface inspection of the conveyed article 11 conveyed on the rotary disc 5.

Please amend the paragraph on page 18, starting at line 7 as follows:

As is different from the conveying belt 52 of the linear conveying portion 8, since it is possible to fix the supporting member 23 to the peripheral edge of the rotary disc portion 5 and it is possible to reduce the cross sectional area of the supporting member 23, it is possible to stably inspect the conveyed article 11 without working against the side surface inspection of the conveyed article 11 and without slipping the conveyed article 11. In particular, when the supporting member 23 [is constituted by] includes a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

Please amend the paragraph on page 18, starting at line 18 as follows:

It is possible to shut the air in the portion of the slit 17 requiring no suction in the rotary disc 5. Accordingly, it is possible to save [a suction air amount, a blower capacity can have a margin and an energy can be saved.] the amount of air suctioning and the working capacity of the blower. Also, energy can be saved.

Please amend the paragraph on page 18, starting at line 21 as follows:

It is possible to inspect each of the side surfaces and both of the front and back surfaces of the conveyed article 11, [and it] It is also possible to sort [in correspondence to the inspected result by the sorting portion 3] the conveyed articles according to the results obtained from the inspection portions of the apparatus.

Please amend the paragraph on page 18, starting at line 24 as follows:

It is possible to align all the small articles having different widths W and

thicknesses T and stabilizing under the turned state in the low attitude, and it is not necessary to sort, so that it is possible to improve a processing efficiency.

Please amend the paragraphs on page 19, starting at line 1 through line 18 as follows:

In accordance with the conveying apparatus described in the first aspect of the present invention, since the apparatus [is constituted by the] includes a rotary disc portion and the linear conveying portion, it is possible to stably convey articles without requiring a lot of space even when the linear conveying portion is arranged horizontally. [, and further it] It is also possible to execute a side surface inspection of the conveyed article conveyed [in] on the rotary disc. In accordance with the conveying apparatus described in the second aspect of the present invention, in addition to the same effects as that of the first aspect, it is possible to fix the supporting member to the peripheral edge of the rotary disc portion being different from the conveying belt in the linear conveying portion and it is possible to make a cross sectional area of the supporting member small, so that it is possible to stably inspect the conveyed article without working against the side surface inspection of the conveyed article and without slipping the conveyed article. In particular, when the supporting member includes a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

Please amend the paragraph on page 19, starting at line 19 as follows:

In accordance with the conveying apparatus described in the third aspect, in addition to the same [effect] effects as that of the second aspect, it is possible to inspect both the front and back surfaces of the conveyed article by the linear conveying portion.

Please amend the paragraph starting on page 19, line 23 as follows:

In accordance with the conveying apparatus described in the fourth aspect, in addition to the same effect as that of the third aspect, it is possible to shut the air of the slit requiring no suction in the rotary disc. Accordingly, it is possible to save [a suction air amount, a blower capacity can have a margin and an energy can be saved] the amount

of air suctioning provided and blower capacity used as well as save energy.

Please amend the paragraph on page 20, starting at line 2 as follows:

In accordance with the inspecting apparatus described in the fifth aspect, in addition to the same effectsas that of the first aspect, the second aspect, the third aspect or the fourth aspect, it is possible to inspect [respective surfaces comprising] the side surface and both the front and back surfaces of the conveyed article, and it is possible to sort in response to the inspected results.

Please amend the paragraph on page 20, starting at line 8 as follows:

In accordance with the aligning and supplying apparatus described in the sixth aspect, it is possible to align all the small articles having [the] different widthsand thicknessesand stabilizing under the turned state in a low attitude, and it is not necessary to sort, so that it is possible to improve[a] the processing efficiency.

IN THE CLAIMS:

Please amend claim 1 as indicated below:

1. (Once Amended) A conveying apparatus comprising:
a rotary disc portion [with a suction means which forms a slit on an outer peripheral surface and sucks through said slit so as to convey a conveyed article in a state of holding the conveyed article by suction to both sides of said slit] having a pair of parallel plate members with a region defined there between;
a gap formed on the region between the pair of parallel plate members;
a first suctioning device disposed to secure an article on the outer peripheral surfaces of the pair of parallel plate members by extracting air from the gap; and
a linear conveying portion [with a suction means which sucks said conveyed article riding over] having a pair of parallel conveying belts [through a gap between said conveying belts so as to convey said conveyed article in a state of holding the conveyed article by suction to said conveying belt, and has one end opposing to said outer peripheral surface of said rotary disc portion so as to be capable of transfer said conveyed

article] with a gap formed there between, the linear conveying portion being in communication with the rotary disc portion to transfer the article from the rotary disc portion to the linear conveying portion.

107089598 #4

DESCRIPTION

CONVEYING APPARATUS, INSPECTING APPARATUS AND ALIGNING AND SUPPLYING

APPARATUS

TECHNICAL FIELD

The present invention relates to a conveying apparatus for a conveyed article inspecting apparatus for inspecting mainly a small article such as a drug medicine (a tablet, a capsule and the like), small confectionery such as a candy and the like, a washer, a button electric cell, or the like as the conveyed article in a defect inspection step, a visual inspection step, a dimensional check step or the like of the conveyed article while conveying the conveyed article, an inspecting apparatus thereof and an aligning and supplying apparatus thereof.

BACKGROUND ART

In the case of detecting respective surfaces of the conveyed article such as the small article or the like while conveying, a plurality of linear apparatuses have been conventionally arranged in series connection so as to be capable of transferring, however, there has been a disadvantage that a wide space to be occupied is required. On the contrary, when placing the conveying apparatuses in a vertical attitude, the occupied space is reduced, however, a required height thereof is significantly increased, and since the conveyed article held by suction is sometimes inclined due to a vibration of the conveying process or an its own weight, it is hard to inspect.

Further, the conveying apparatus for conveying the conveyed article in a linear direction is structured, for example, such that the conveyed article is mounted so as to ride over a pair of parallel belts and is conveyed

while being held by suction by a suction means through a gap between the belts, so that since the belts can not be elongated and narrowed in order to resist a tensile strength, in the case that the conveyed article mounted on the belts is a small article, side surfaces thereof are supported between the belts deeply and the side surface of the conveyed article can not be sufficiently inspected.

Further, since a conventional rotary disc is structured such that a contact portion with the conveyed article is made, for example, of an aluminum metal or the like, the contact portion is easily slipped due to a low coefficient of friction, whereby a conveying state is easily changed due to a weight of the conveyed article.

Further, the structure of this kind of rotary disc apparatus (for example, Japanese Patent Application Laid-Open No. 61-212374) is provided with movable opposing plates constituted by a pair of mutually opposing rotary discs and having a slit which is provided in peripheral portions of the rotary discs and continuously all around the periphery thereof and has an opposing gap smaller than the small article, and a suction means having a rotary tube shaft concentrically pierced in an inner side of the movable opposing plates, communicating with an inner portion of the rotary tube shaft and sucking an air from the slit to an inner side of the movable opposing plates. However, since the rotary tube shaft is provided, the air is unnecessarily sucked from the slit corresponding to a portion requiring no suction.

Further, in the case of supplying the conveyed article to the conveying apparatus, the aligning and supplying apparatus is used. The conventional aligning and supplying apparatus is structured such that the conveyed article supplied on a turn table is exposed to an aligning operation of an aligning guide together with a rotation of the turn table; and is gradually aligned

along a peripheral wall. The conveyed article reaching a thickness gate from the aligning guide is sorted on the border of a predetermined thickness, and the conveyed article having a thickness equal to or less than the thickness passes through the thickness gate so as to reach a width guide. The conveyed article reaching the width guide is sorted on the border of a predetermined width, and the conveyed article having a width equal to or less than the width passes through the width guide so as to be fed out to the conveying apparatus.

However, the article having the different width and thickness and being stable in a state of turning at 90 degrees, such as the tablet or the like is sorted at the thickness gate. The more a rate of the 90 degrees turn becomes, the more a number or an amount thereof sorted by the thickness gate becomes, whereby the number of the conveyed article fed out to the conveying apparatus is reduced. Accordingly, a processing efficiency is significantly deteriorated.

Accordingly, an object of the present invention is to provide a conveying apparatus which can stably execute a side surface inspection of a small article without requiring a lot of space, stably execute an inspection in a rotary disc apparatus and shut out an air in a portion requiring no suction.

Further, another object of the present invention is to provide an aligning and supplying apparatus which can improve a processing efficiency even in a small article having different width and thickness and being stable in a turned state.

DISCLOSURE OF THE INVENTION

In accordance with a first aspect of the present invention, there is provided a conveying apparatus comprising:

a rotary disc portion with a suction means which forms a slit on an outer peripheral surface and sucks through the slit so as to convey a conveyed article in a state of holding the conveyed article by suction to both sides of the slit; and

a linear conveying portion with a suction means which sucks the conveyed article riding over a pair of parallel conveying belts through a gap between the conveying belts so as to convey the conveyed article in a state of holding the conveyed article by suction to the conveying belt, and has one end opposing to the outer peripheral surface of the rotary disc portion so as to be capable of transfer the conveyed article.

In accordance with the conveying apparatus described in the first aspect of the present invention, since the apparatus is constituted by the rotary disc portion and the linear conveying portion, it is possible to stably convey without requiring a lot of space even when the linear conveying portion is arranged horizontally, and further it is possible to execute a side surface inspection of the conveyed article conveyed in the rotary disc.

In accordance with a second aspect of the present invention, there is provided a conveying apparatus as described in the first aspect, wherein a ring-like supporting member having a high friction coefficient is provided in both sides of the slit along the outer peripheral surface of the rotary disc.

In accordance with the conveying apparatus described in the second aspect of the present invention, in addition to the same effect as that of the first aspect, it is possible to fix the supporting member to the peripheral edge of the rotary disc portion being different from the conveying belt in the linear conveying portion and it is possible to make a cross sectional area of the supporting member small, so that it is possible to stably inspect

the conveyed article without working against the side surface inspection of the conveyed article and without slipping the conveyed article. In particular, when the supporting member is constituted by a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

In accordance with a third aspect of the present invention, there is provided a conveying apparatus as described in the second aspect, wherein the linear conveying portion is constituted by a first conveying portion and a second conveying portion having the same structure, one end of the first conveying portion opposes to the outer peripheral surface of the rotary disc portion so as to be capable of transferring the conveyed article, and one end of the second conveying portion opposes to another end of the first conveying portion so as to be capable of transferring the conveyed article.

In accordance with the conveying apparatus described in the third aspect, in addition to the same effect as that of the second aspect, it is possible to inspect both of front and back surfaces of the conveyed article by the linear conveying portion.

In accordance with a fourth aspect of the present invention, there is provided a conveying apparatus as described in the third aspect, further comprising an aligning and supplying apparatus for aligning the conveyed article so as to supply to the outer peripheral surface of the rotary disc portion in an opposite side to the first conveying portion of the rotary disc portion, and an air shutting means for closing the slit of the peripheral surface portion other than the peripheral surface portion reaching the first conveying portion from the aligning and supplying apparatus in a rotational direction of the rotary disc portion.

In accordance with the conveying apparatus described in the fourth

aspect, in addition to the same effect as that of the third aspect, it is possible to shut the air of the slit requiring no suction in the rotary disc. Accordingly, it is possible to save a suction air amount, a blower capacity can have a margin and an energy can be saved.

In accordance with a fifth aspect of the present invention, there is provided an inspecting apparatus using the conveying apparatus described in the first aspect, the second aspect, the third aspect or the fourth aspect, comprising:

a side surface inspecting portion for inspecting a side surface of the conveyed article on the rotary disc portion;

a front surface inspecting portion for inspecting a surface of the conveyed article on the first conveying portion;

a back surface inspecting portion for inspecting a back surface of the conveyed article on the second conveying portion; and

a sorting portion for sorting the conveyed article in response to an inspected result.

In accordance with the inspecting apparatus described in the fifth aspect, in addition to the same effect as that of the first aspect, the second aspect, the third aspect or the fourth aspect, it is possible to inspect respective surfaces comprising the side surface and both the surfaces of the front and back surfaces of the conveyed article, and it is possible to sort in response to an inspected result in the sorting portion.

In accordance with a sixth aspect of the present invention, there is provided an aligning and supplying apparatus for mounting a conveyed article having different thickness and width and capable of being stably mounted by setting a thickness direction or a width direction to a vertical direction, respectively, comprising:

a turn table in which a step portion having a predetermined height is provided along a peripheral edge of a mounting surface;

a width guide crossing to the step portion in such a manner as to guide the conveyed article mounted on the mounting surface from a center side to an outer peripheral side due to a rotation of the turn table, having one end positioned at the center side of the turn table rather than the step portion and having another end protruding outward from the outer periphery of the step portion so as to be fixed; and

a thickness gate arranged in an upper side of the conveyed article passing within the width guide on the turn table, and having a projection portion protruding toward the conveyed article so as to be capable of getting down the conveyed article in a high attitude on the step portion without getting down the conveyed article in a low attitude at a time when the conveyed article moving along the width guide due to the rotation of the turn table rides over the step portion.

In accordance with the aligning and supplying apparatus described in the sixth aspect, it is possible to align all the small articles having the different width and thickness and stabilizing under the turned state in a low attitude, and it is not necessary to sort, so that it is possible to improve a processing efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view of an embodiment in accordance with the present invention;

Fig. 2 is a cross sectional view of a rotary disc portion;

Fig. 3 is a front elevational view of a state that one of rotary discs is taken out;

Fig. 4 is a cross sectional view of the state shown in Fig. 3;
Fig. 5 is a side elevational view of the rotary disc portion;
Fig. 6 is a front elevational view of the rotary disc portion;
Fig. 7 is a partly plan view of an aligning and supplying apparatus;
Fig. 8 is a cross sectional view of a turn table of the aligning and supplying apparatus shown in Fig. 7;

Fig. 9A is a cross sectional view along a line A-A in Fig. 7 in the case that a conveyed article has a high attitude;

Fig. 9B is a cross sectional view along a line B-B in Fig. 7;

Fig. 9C is a cross sectional view along a line C-C in Fig. 7;

Fig. 10A is a cross sectional view along a line A-A in Fig. 7 in the case that a conveyed article has a low attitude;

Fig. 10B is a cross sectional view along a line B-B in Fig. 7; and

Fig. 10C is a cross sectional view along a line C-C in Fig. 7.

A description will be given below of reference numerals described in the drawings.

Reference numeral 1 denotes a conveying apparatus. Reference numeral 2 denotes an inspecting portion. Reference numeral 3 denotes a sorting portion. Reference numeral 4 denotes an aligning and supplying apparatus. Reference numeral 5 denotes a rotary disc portion. Reference numeral 6 denotes a first conveying portion. Reference numeral 7 denotes a second conveying portion. Reference numeral 8 denotes a linear conveying portion. Reference numeral 10 denotes a turn table, and reference numeral 10a denotes a mounting surface. Reference numeral 11 denotes a conveyed article. Reference numeral 12 denotes a side surface inspecting portion. Reference numeral 13 denotes a front surface inspecting portion. Reference numeral 14 denotes a back surface inspecting portion. Reference numeral 15 denotes a width guide. Reference numeral 17

denotes a slit. Reference numeral 18 denotes a motor. Reference numeral 19 denotes a drive shaft. Reference numerals 20 and 21 denote a rotary disc. Reference numeral 22 denotes a suction duct. Reference numeral 23 denotes a supporting member. Reference numeral 32 denotes an air shutting means. Reference numeral 52 denotes a conveying belt. Reference numeral 55 denotes a thickness gate. Reference numeral 56 denotes a step portion. Reference numeral 57 denotes a projection portion.

BEST MODE FOR CARRYING OUT THE INVENTION

A description will be given of an embodiment in accordance with the present invention with reference to Figs. 1 to 10. Fig. 1 shows an inspecting apparatus, which has a conveying apparatus 1, an inspecting portion 2 and a sorting portion 3.

A conveying apparatus 1 has an aligning and supplying apparatus 4, a rotary disc portion 5, a first conveying portion 6 and a second conveying portion 7. The first conveying portion 6 and the second conveying portion 7 constitute a linear conveying portion 8. The aligning and supplying apparatus 4 is structured such that a conveyed article 11, for example, a small article, in this case, particularly a tablet is mounted on a turn table 10, and the conveyed article 11 is aligned along a peripheral edge portion in correspondence to a rotation of the turn table 10 by an aligning guide (not shown) arranged over the turn table 10 with a slight gap and is linearly fed by a width guide 15 (mentioned below) arranged near the peripheral edge portion of the turn table 10 with a slight gap so as to be supplied to the rotary disc portion 5.

The inspecting portion 2 has two side surface inspecting portions 12 for individually inspecting both side surfaces of the conveyed article

11 on the rotary disc portion 5 one side by one side, a front surface inspecting portion 13 for inspecting a front surface of the conveyed article 11 on the first conveying portion 6, and a back surface inspecting portion 14 for inspecting a back surface of the conveyed article 11 appearing upside on the second conveying portion 7. For example, a known structure provided with a light source illuminating the conveyed article 11 and a television camera picking up an image of the conveyed article 11 is applied to each of the structures in the inspecting portion 2 (for example, Japanese Patent Application Publication No. 6-088656).

The sorting portion 3 sorts the conveyed article 11 in response to an inspected result. The data obtained in the inspecting portion 2 is fed to a control means, for example, an analyzer or the like so as to be compared with a reference data, an analysis for obtaining an acceptable article data or a defective article data is executed, the data is transmitted to the sorting portion 3, a timing that the sorted portion 11 comes to the sorting portion 3 is taken by counting the conveyed article 11 passing through the inspecting portion 2, and the conveyed article 11 is divided into an acceptable article collecting duct and a defective article collecting duct due to a blowing such as an air pressure in the sorting portion 3 in response to the inspected result, whereby the sorting operation is executed. The known structure is employed for the structure of the sorting portion 3.

Fig. 2 shows a cross section of the rotary disc portion 5 with the suction means. A slit 17 is formed on an outer peripheral surface of the rotary disc portion 5, and the conveyed article 11 is conveyed in a state of being held by suction to both sides of the slit 17 by sucking through the slit 17. In the embodiment, the structure has a motor 18, a pair of rotating discs 20 and 21 mounted to a drive shaft 19 of the motor 18, opposing to

each other so that peripheral edges are close to each other and forming the slit 17 therebetween, for example, using plate-like discs, and a fixed suction duct 22 rotatably mounting the drive shaft 19 of the motor 18. A pair of rotary discs 20 and 21 are mounted to a tubular connecting member 60 fitted to the drive shaft 19 so as to determine an interval of the slit 17. A ring-like supporting member 23 having a high friction coefficient is provided in both sides of the slit 17 along the outer peripheral surfaces of the rotary discs 20 and 21. In the embodiment, a peripheral groove 24 is formed in each of the outer peripheral edges of the rotary discs 20 and 21, the supporting member 23 having a large friction coefficient, for example, an O-ring made of a article having an adhesive property and a buffering property, for example, a rubber or the like is attached thereto, and an interval of the slit 17 between the O-rings is set to be smaller than a size of the conveyed article 11, for example, about 1 mm. The suction duct 22 is mounted to the drive shaft 19 of the motor 18 via a bearing 25, moves the suction duct 22 close to one rotary disc 21 so as to form a gap 30 at an interval t , for example, about 0.5 mm, forms sucking holes 26 and 27 respectively communicating with opposing portions thereof, is provided with a sucking connection portion 28 on a side surface of the suction duct 22, and connects a known suction means (not shown) to the sucking connection portion 28. Accordingly, when taking out an air within the suction duct 22 by operating the suction means, a space between a pair of rotary discs 20 and 21 becomes negative pressure through the sucking holes 26 and 27, whereby the air is sucked from the slit 17 between the rotary discs 20 and 21. At this time, the gap 30 between the suction duct 22 and the rotary disc 21 achieves a seal effect due to a pressure loss of a fine interval. When mounting the conveyed article 11 such as the tablet or the like on the supporting member 23, the conveyed article 11 is

held by suction to the supporting member 23 due to an air pressure, and when the rotary discs 20 and 21 rotate in correspondence to the rotation of the motor 18, the conveyed article 11 moves around a circumference of the rotary discs 20 and 21 in connection with the rotation of the rotary discs 20 and 21. Accordingly, the conveyed article 11 dropped down to the rotary disc portion 5 from the aligning and supplying means 4 as shown in Fig. 1 passes through the side surface inspecting portion 12 so as to be applied to the side surface inspection while being held by suction by the slit 17, and is conveyed toward the first conveying portion 6.

Reference numeral 32 denotes an air shutting means. The air shutting means 32 closes the slit 17 of the peripheral surface portion 33 other than a peripheral surface portion reaching the first conveying portion 6 from the aligning and supplying apparatus 4 in the rotational direction of the rotary disc portion 5. In the embodiment, a center portion thereof is supported to the drive shaft 19 of the motor 18 via the bearing 34 and a peripheral edge portion 35 is positioned so as to close the slit 17 of the peripheral surface portion 33.

Fig. 3 shows an air shutting means 32. The air shutting means 32 is constituted by a substantially meniscus-shaped disc 36, a semicircular protruding portion 37 is provided in a center portion of a flat portion 36, the bearing 34 is provided in the protruding portion 37, and the bearing 34 is fitted to the drive shaft 19 of the motor 18, whereby the disc 36 is supported to the drive shaft 19. A wind guide 39 for obliquely guiding a wind at a position of the slit 17 is provided at both ends of the flat portion 36a of the disc 36. Further, a fixed plate receiving groove 40 is formed in a part of a circumferential portion of the disc 36, a pair of fixed pins 41 are provided within the fixed plate receiving groove 40 in a standing

manner, a front end of a fixed plate 45 having a thickness of about 0.5 mm is inserted and attached within the fixed plate receiving groove 40 between the fixed pins 41 through the slit 17, a long hole 46 longer in an inserting direction is formed at a rear end of the fixed plate 45, a fixing means inserted to the long hole 46, for example, a thumb screw 47 is fastened to one end of a fixed member 48, and the fixed plate 45 is fixed to a vertical base 49 (Fig. 5) via the fixed member 48 so as to be capable of adjusting. Accordingly, the air sucked by the suction means and moving forward from the slit 17 is limited to a portion of the rotary discs 20 and 21 where the disc 36 does not exist. In this case, one of the wind guide 39 faces to the aligning and supplying means 4.

Fig. 4 shows the groove 40 and the pin 41 to which the fixed plate 45 of the disc 36 is inserted.

Fig. 5 shows a state that another end of the fixed member 48 is mounted to the vertical base 49 to which the motor 18 is mounted, and the fixed plate 45 is fixed to one end of the fixed member 48 by the thumb screw 47. Reference numeral 50 denotes a fixing device for fixing the rotary disc 20 to the tubular connection member 60 (Fig. 2).

Fig. 6 is a front elevational view of the rotary discs 20 and 21.

The linear conveying portion 8 with the suction means sucks the conveyed article 11 riding over a pair of parallel conveying belts 52 through the gap between the conveying belts 52 as shown in Fig. 1, thereby holding the conveyed article 11 by suction to the conveying belt 52 so as to convey, in which one end opposes the outer peripheral surface of the rotary disc portion 5 so as to be capable of transferring the conveyed article 11. This linear conveying portion 8 is, as shown in Fig. 1, constituted by the first conveying portion 6 and the second conveying portion 7 having the same structure,

one end of the first conveying portion 6 opposes to another of the wind guide 39 on the outer peripheral surface of the rotary disc portion 5 so as to be capable of transferring the conveyed article 11, and one end of the second conveying portion 7 opposes to another end of the first conveying portion 6 so as to be capable of transferring the conveyed article 11. Reference numerals 6a, 6b, 7a and 7b denote a ring body winding the conveying belt 52 therearound, for example, a pulley or the like. The ring bodies 6a, 6b, 7a and 7b connect one of the first conveying portion 6 and the second conveying portion 7 to a rotation driving means. The known structure is applied to the linear conveying portion 8 (for example, Japanese Patent Application Publication No. 5-065405).

Further, as shown in Fig. 1, the aligning and supplying apparatus 4 for aligning the conveyed article 11 so as to supply to the outer peripheral surface of the rotary disc portion 5 is positioned in an opposite side of the rotary disc portion 5 to the first conveying portion 6.

Figs. 7 and 8 are views showing details of the aligning and supplying apparatus 4 (in this case, a rotational direction of the turn table 10 is set to be opposite to Fig. 1). The aligning and supplying apparatus 4 is structured, for example, such as to mount the conveyed article 11 having different thickness T and width W (refer to Fig. 10) and capable of being stably mounted in a state of setting a thickness direction or a width direction to a vertical direction. For example, this is a tablet in which a width is about 6 mm, a thickness is about 5 mm and a length is longer than these. The aligning and supplying apparatus 4 has a turn table 10, a width guide 15, a thickness gate 55, an aligning guide (not shown) and a peripheral wall (not shown). The turntable 10 is structured such that a sheet having a thickness of about 0.5 mm is adhered to a mounting surface 10a, and a step portion

56 having a predetermined height is provided along a peripheral edge of the mounting surface 10a. The step portion 56 is structured, as shown in Fig. 8, such that a sheet, for example, having a thickness of about 0.5 mm is adhered to an outer periphery.

The aligning guide employs a known means, and is structured such as to align the conveyed article 11 mounted on the mounting surface 10a so as to be along the peripheral edge portion of the turn table 10.

The peripheral wall (not shown) is arranged in the peripheral edge portion of the turn table 10 with a slight gap, and is structured such as to prevent the conveyed article 11 on the turn table 10 from moving out of the turn table 10 from the portion other than the width guide 15.

The width guide 15 crosses to the step portion 56 so as to guide the conveyed article 11 mounted on the mounting surface 10a to the outer peripheral side from the center side due to the rotation of the turn table 10, for example, linearly, one end is positioned close to a center side of the turn table rather than the step portion 56, and another end protrudes outward from the outer periphery of the step portion 56 so as to be fixed (the fixing means is not shown). A width of the width guide 15 in accordance with the embodiment is set to a size capable of guiding the conveyed article 11 whichever of the width direction and the thickness direction is set to the vertical direction, and the conveyed article 11 aligned by the aligning guide is introduced within the width guide 15.

Figs. 9 and 10 describe an operation within the width guide 15 and the thickness gate 55. Figs. 9A and 10A show a cross section along a line A-A in Fig. 7, Figs. 9B and 10B show a cross section along a line B-B in Fig. 7, and Figs. 9C and 10C show a cross section along a line C-C in Fig. 7. The thickness gate 55 is arranged in an upper side of the conveyed article

11 passing within the width guide 15 on the turn table 10, and has a projection portion 57 protruding toward the conveyed article 11 so as to be capable of getting down the conveyed article 11 in a high attitude on a step portion 56 without getting down the conveyed article 11 in a low attitude at a time when the conveyed article 11 moving along the width guide 15 due to the rotation of the turn table 10 rides over the step portion 56. In the embodiment, the thickness gate 55 is set to a height at which the conveyed article 11 can enter within the width guide 15 even in the high attitude, and the projection portion 57 is provided in one side of the width guide 15, that is, an opposite side to a side from which the step portion 56 progressively enters, so as to protrude such a degree as to contact with a side surface at an upper end of the conveyed article 11 in the high attitude, thereby getting down the conveyed article 11.

Figs. 9A, 9B and 9C show a state in which the conveyed article 11 in the high attitude, that is, the tablet is mounted on the turn table 10 by setting the width direction to the vertical direction, and Fig. 9A shows a state in which the conveyed article 11 is introduced within the thickness gate 55 and the width guide 15. Fig. 9B shows a state in which the step portion 56 moves forward to about half in the width direction so as to press the side portion in the mounting side of the conveyed article 11 while the conveyed article 11 moves along one side wall of the width guide 15 due to the rotation of the turn table 10, whereby the upper end side surface of the conveyed article 11 is brought into contact with the projection portion 57 so as to be tilted in a get-down attitude. Fig. 9C shows a state in which the step portion 56 completely enters within the width guide 15. At this time, the conveyed article 11 rides over the step portion 56, and the conveyed article 11 simultaneously gets down on the step portion 56 so as to become in the

low attitude in which the thickness direction is set to the vertical direction. Thereafter, as shown in Fig. 7, the conveyed article 11 further moves along the width guide 15, drops down from the peripheral edge portion of the turn table 10 and drops down on the slit 17 of the rotary disc portion 5 so as to be held by suction.

Figs. 10A, 10B and 10C show a state in which the conveyed article 11 in the low attitude, that is, the conveyed article 11 is mounted on the turn table 10 by setting the thickness direction to the vertical direction, and Fig. 10A shows a state in which the conveyed article 11 is introduced within the thickness gate 55 and the width guide 15. Fig. 10B shows a state in which the step portion 56 moves forward to about half in the width direction so as to press the side portion in the mounting side of the conveyed article 11 while the conveyed article 11 moves along one side wall of the width guide 15 due to the rotation of the turn table 10, whereby the conveyed article 11 is going to ride over the step portion 56. At this time, since the projection portion 57 has a size not being brought into contact with the side surface of the upper end portion of the conveyed article 11 as mentioned above, the projection portion 57 is not tilted while being brought into contact with one side wall of the width guide 15, and even when it is going to be tilted, the upper end surface of the conveyed article 11 is brought into contact with the lower surface of the projection portion 57 so as to prevent the projection portion 57 from being tilted. Fig. 10C shows a state in which the step portion 56 completely enters within the width guide 15. At this time, the conveyed article 11 rides over the step portion 56. The later operations are the same as those described in Fig. 9, and in any case, the conveyed article 11 drops down to the peripheral edge portion of the rotary disc portion so as to be held by suction by setting the thickness T direction

to the vertical direction.

In accordance with this embodiment, since the apparatus is constituted by the rotary disc portion 5 and the linear conveying portion 8, it is possible to stably convey with saving a space even when arranging the linear conveying portion 8 horizontally, and it is possible to execute the side surface inspection of the conveyed article 11 conveyed on the rotary disc 5.

As is different from the conveying belt 52 of the linear conveying portion 8, since it is possible to fix the supporting member 23 to the peripheral edge of the rotary disc portion 5 and it is possible to reduce the cross sectional area of the supporting member 23, it is possible to stably inspect the conveyed article 11 without working against the side surface inspection of the conveyed article 11 and without slipping the conveyed article 11. In particular, when the supporting member 23 is constituted by a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

It is possible to inspect both of the front and back surfaces of the conveyed article 11 by the linear conveying portion 8.

It is possible to shut the air in the portion of the slit 17 requiring no suction in the rotary disc 5. Accordingly, it is possible to save a suction air amount, a blower capacity can have a margin and an energy can be saved.

It is possible to inspect each of the side surfaces and both of the front and back surfaces of the conveyed article 11, and it is possible to sort in correspondence to the inspected result by the sorting portion 3.

It is possible to align all the small articles having the different width W and thickness T and stabilizing under the turned state in the low attitude, and it is not necessary to sort, so that it is possible to improve a processing efficiency.

INDUSTRIAL APPLICABILITY

In accordance with the conveying apparatus described in the first aspect of the present invention, since the apparatus is constituted by the rotary disc portion and the linear conveying portion, it is possible to stably convey without requiring a lot of space even when the linear conveying portion is arranged horizontally, and further it is possible to execute a side surface inspection of the conveyed article conveyed in the rotary disc.

In accordance with the conveying apparatus described in the second aspect of the present invention, in addition to the same effect as that of the first aspect, it is possible to fix the supporting member to the peripheral edge of the rotary disc portion being different from the conveying belt in the linear conveying portion and it is possible to make a cross sectional area of the supporting member small, so that it is possible to stably inspect the conveyed article without working against the side surface inspection of the conveyed article and without slipping the conveyed article. In particular, when the supporting member is constituted by a structure having a buffering property and an adhesive property, for example, an O-ring, it is possible to convey at a high speed and stably.

In accordance with the conveying apparatus described in the third aspect, in addition to the same effect as that of the second aspect, it is possible to inspect both of front and back surfaces of the conveyed article by the linear conveying portion.

In accordance with the conveying apparatus described in the fourth aspect, in addition to the same effect as that of the third aspect, it is possible to shut the air of the slit requiring no suction in the rotary disc. Accordingly, it is possible to save a suction air amount, a blower capacity

can have a margin and an energy can be saved.

In accordance with the inspecting apparatus described in the fifth aspect, in addition to the same effect as that of the first aspect, the second aspect, the third aspect or the fourth aspect, it is possible to inspect respective surfaces comprising the side surface and both the surfaces of the front and back surfaces of the conveyed article, and it is possible to sort in response to an inspected result in the sorting portion.

In accordance with the aligning and supplying apparatus described in the sixth aspect, it is possible to align all the small articles having the different width and thickness and stabilizing under the turned state in a low attitude, and it is not necessary to sort, so that it is possible to improve a processing efficiency.

WHAT IS CLAIMED IS:

1. A conveying apparatus comprising:

a rotary disc portion with a suction means which forms a slit on an outer peripheral surface and sucks through said slit so as to convey a conveyed article in a state of holding the conveyed article by suction to both sides of said slit; and

a linear conveying portion with a suction means which sucks said conveyed article riding over a pair of parallel conveying belts through a gap between said conveying belts so as to convey said conveyed article in a state of holding the conveyed article by suction to said conveying belt, and has one end opposing to said outer peripheral surface of said rotary disc portion so as to be capable of transfer said conveyed article.
2. A conveying apparatus as claimed in claim 1, wherein a ring-like supporting member having a high friction coefficient is provided in both sides of said slit along the outer peripheral surface of the rotary disc.
3. A conveying apparatus as claimed in claim 2, wherein said linear conveying portion is constituted by a first conveying portion and a second conveying portion having the same structure, one end of said first conveying portion opposes to the outer peripheral surface of said rotary disc portion so as to be capable of transferring said conveyed article, and one end of said second conveying portion opposes to another end of said first conveying portion so as to be capable of transferring said conveyed article.
4. A conveying apparatus as claimed in claim 3, further comprising:

an aligning and supplying apparatus for aligning said conveyed article so as to supply to said outer peripheral surface of said rotary disc portion in an opposite side to said first conveying portion of said rotary disc portion; and

an air shutting means for closing said slit of the peripheral surface portion other than the peripheral surface portion reaching said first conveying portion from said aligning and supplying apparatus in a rotational direction of said rotary disc portion.

5. An inspecting apparatus using the conveying apparatus claimed in claim 1, 2, 3 or 4, comprising:

a side surface inspecting portion for inspecting a side surface of said conveyed article on said rotary disc portion;

a front surface inspecting portion for inspecting a surface of said conveyed article on said first conveying portion;

a back surface inspecting portion for inspecting a back surface of said conveyed article on said second conveying portion; and

a sorting portion for sorting said conveyed article in response to an inspected result.

6. An aligning and supplying apparatus for mounting a conveyed article having different thickness and width and capable of being stably mounted by setting a thickness direction or a width direction to a vertical direction, respectively, comprising:

a turn table in which a step portion having a predetermined height is provided along a peripheral edge of a mounting surface;

a width guide crossing to said step portion in such a manner as to guide said conveyed article mounted on said mounting surface from a center side to an outer peripheral side due to a rotation of said turn table, having one end positioned at the center side of said turn table rather than said step portion and having another end protruding outward from the outer periphery of said step portion so as to be fixed; and

a thickness gate arranged in an upper side of said conveyed article

passing within said width guide on said turn table, and having a projection portion protruding toward said conveyed article so as to be capable of getting down said conveyed article in a high attitude on said step portion without getting down said conveyed article in a low attitude at a time when said conveyed article moving along said width guide due to the rotation of said turn table rides over said step portion.

ABSTRACT OF THE DISCLOSURE

A conveying apparatus of the invention is provided with a rotary disc portion (2) with a suction means which forms a slit (17) on an outer peripheral surface and sucks through the slit (17) so as to convey a conveyed article in a state of holding the conveyed article (11) by suction to both sides of the slit (17), and a linear conveying portion (8) with a suction means which sucks the conveyed article (11) riding over a pair of parallel conveying belts (52) through a gap between the conveying belts (52) so as to convey the conveyed article (11) in a state of holding the conveyed article by suction to the conveying belt (52), and has one end opposing to the outer peripheral surface of the rotary disc portion (2) so as to be capable of transfer the conveyed article (11). In accordance with the conveying apparatus of the invention, the inspecting apparatus and an aligning and supplying apparatus can execute a side surface inspection of a small article stably without requiring a lot of space.

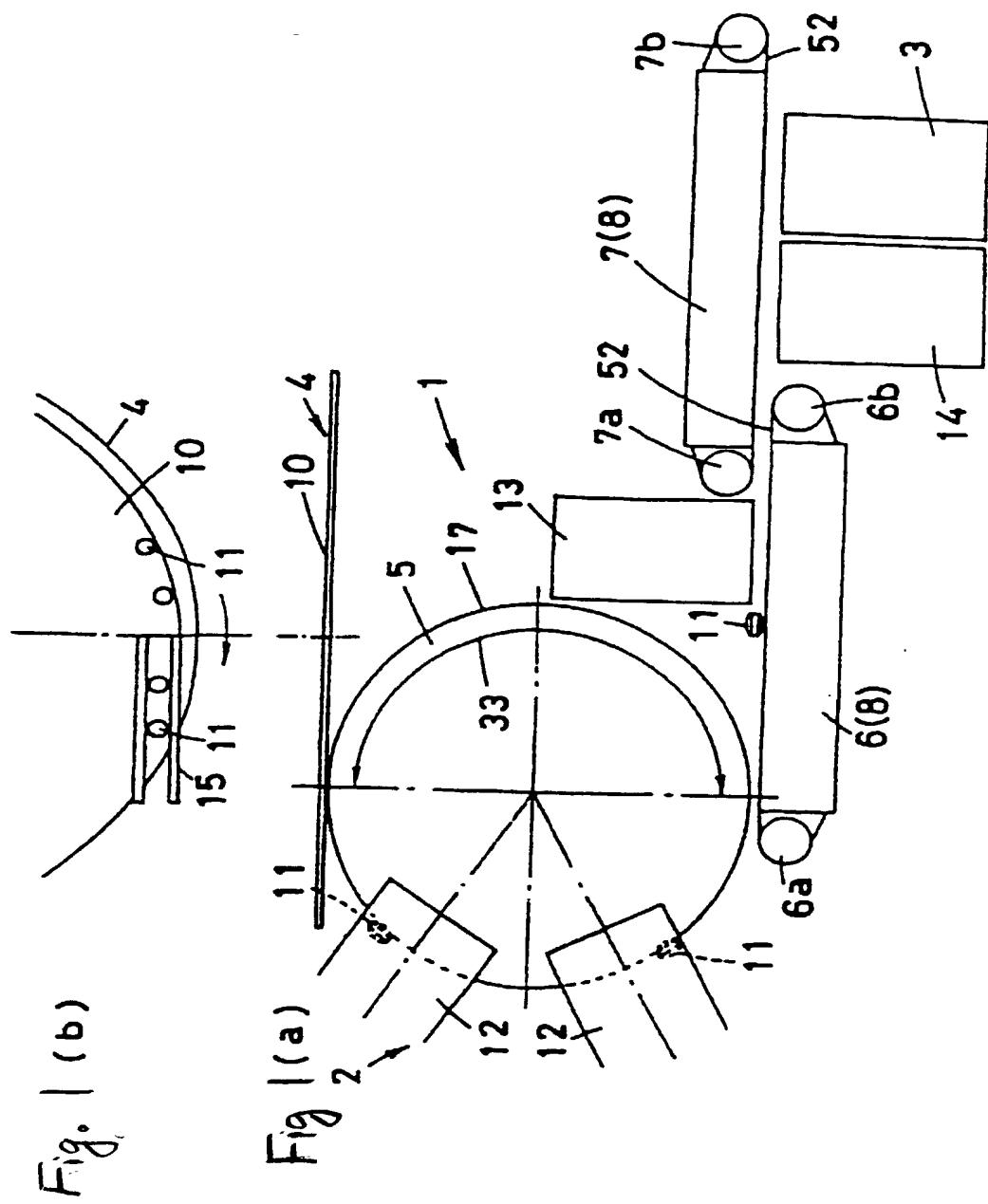


Fig. 2

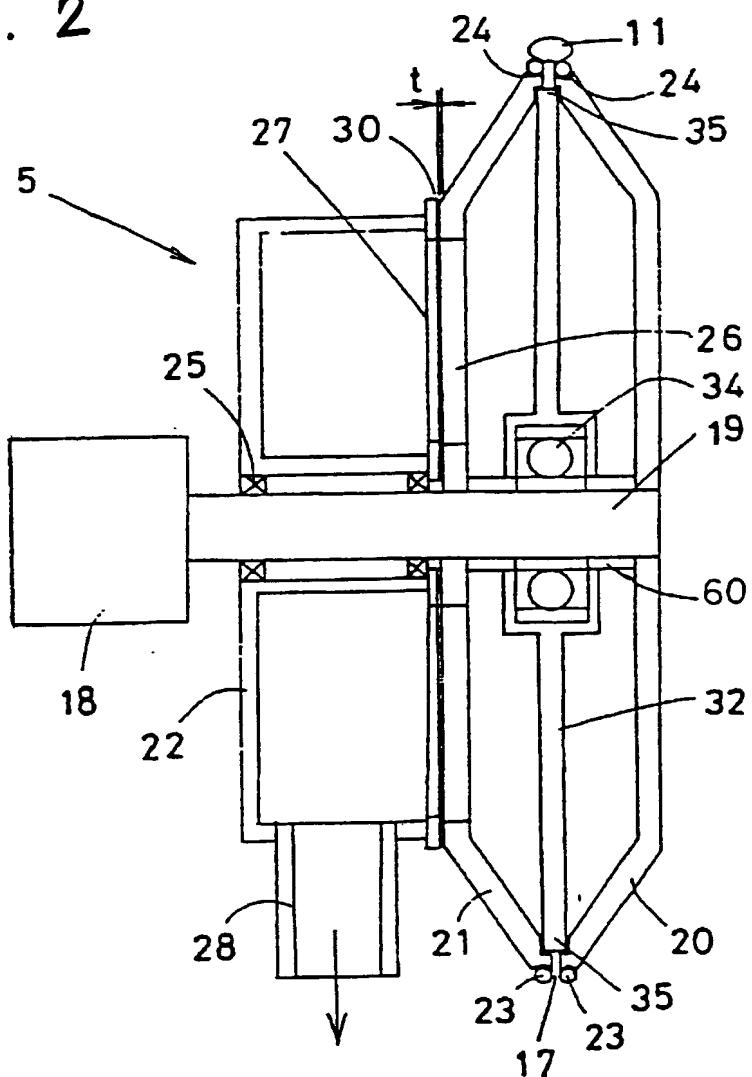
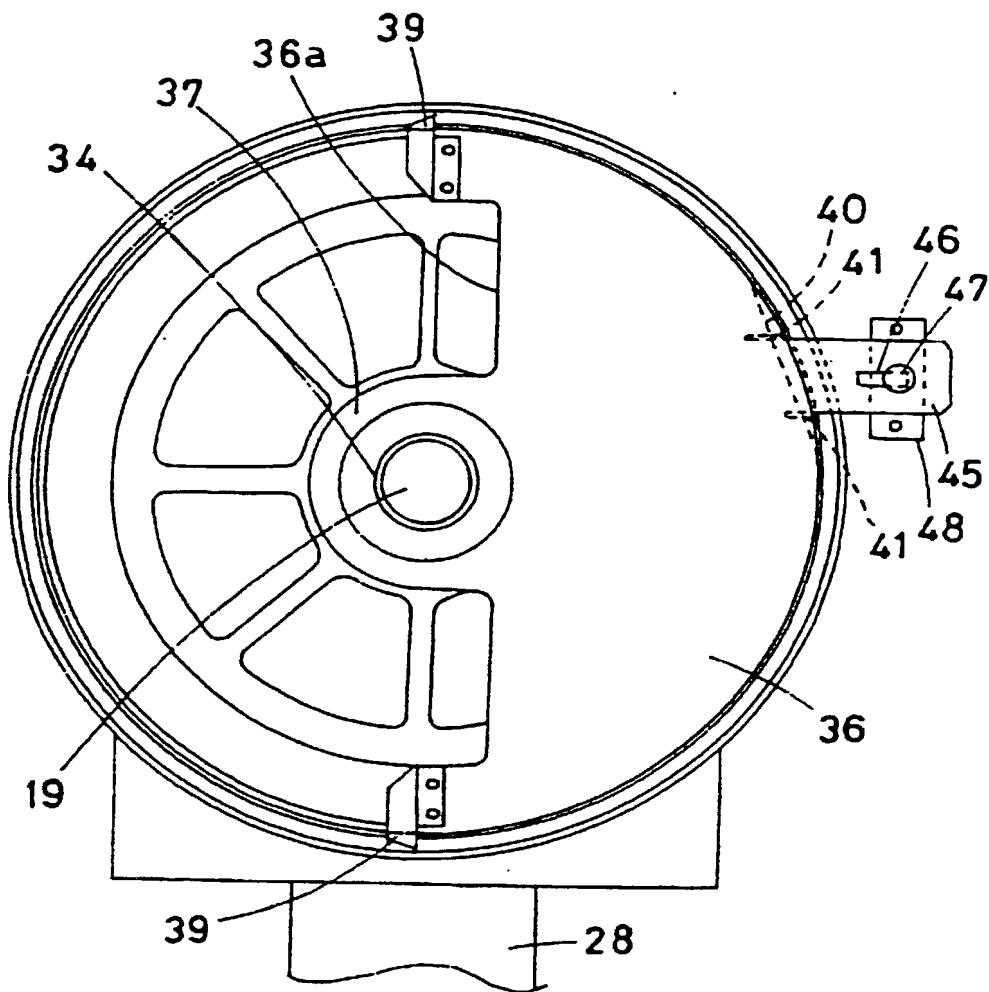


Fig. 3



10/089598

Fig. 4

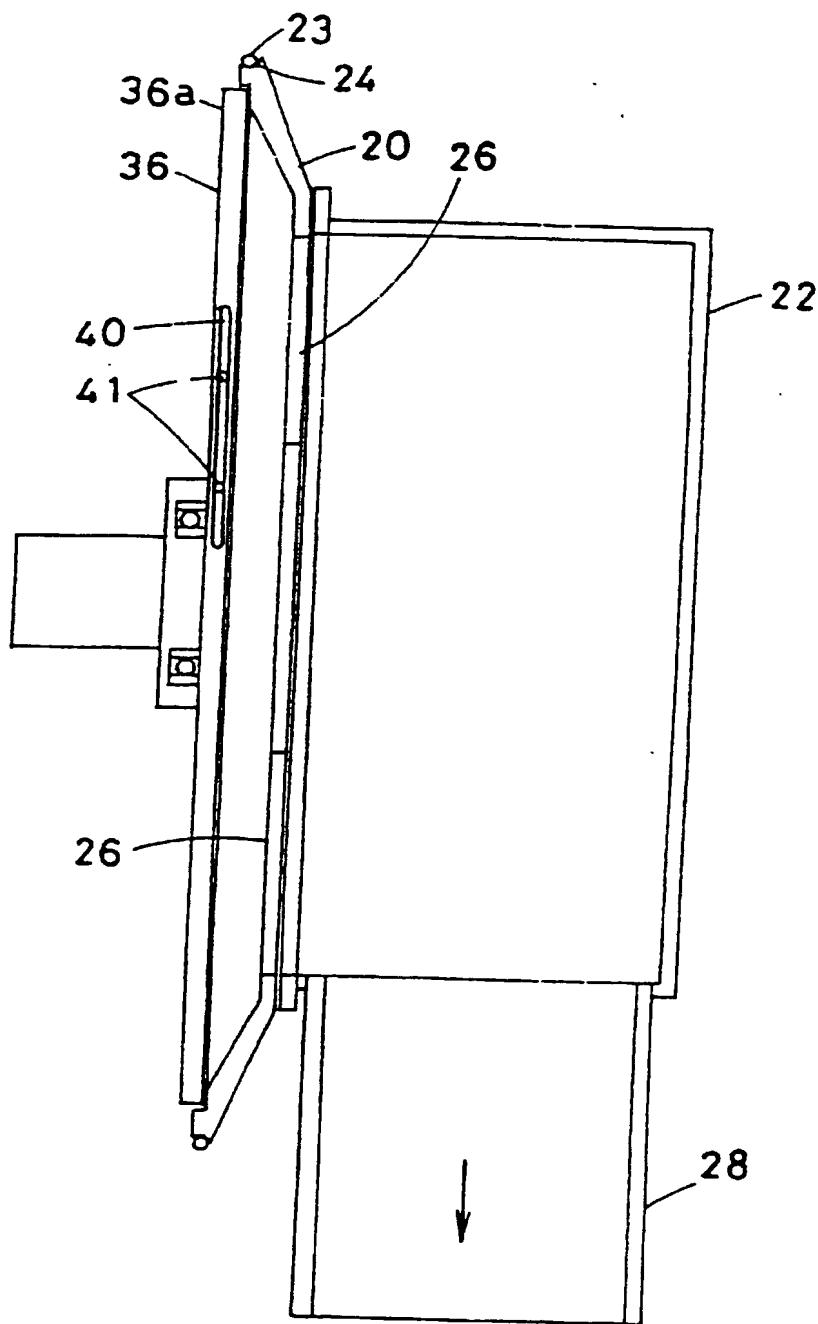


Fig. 5

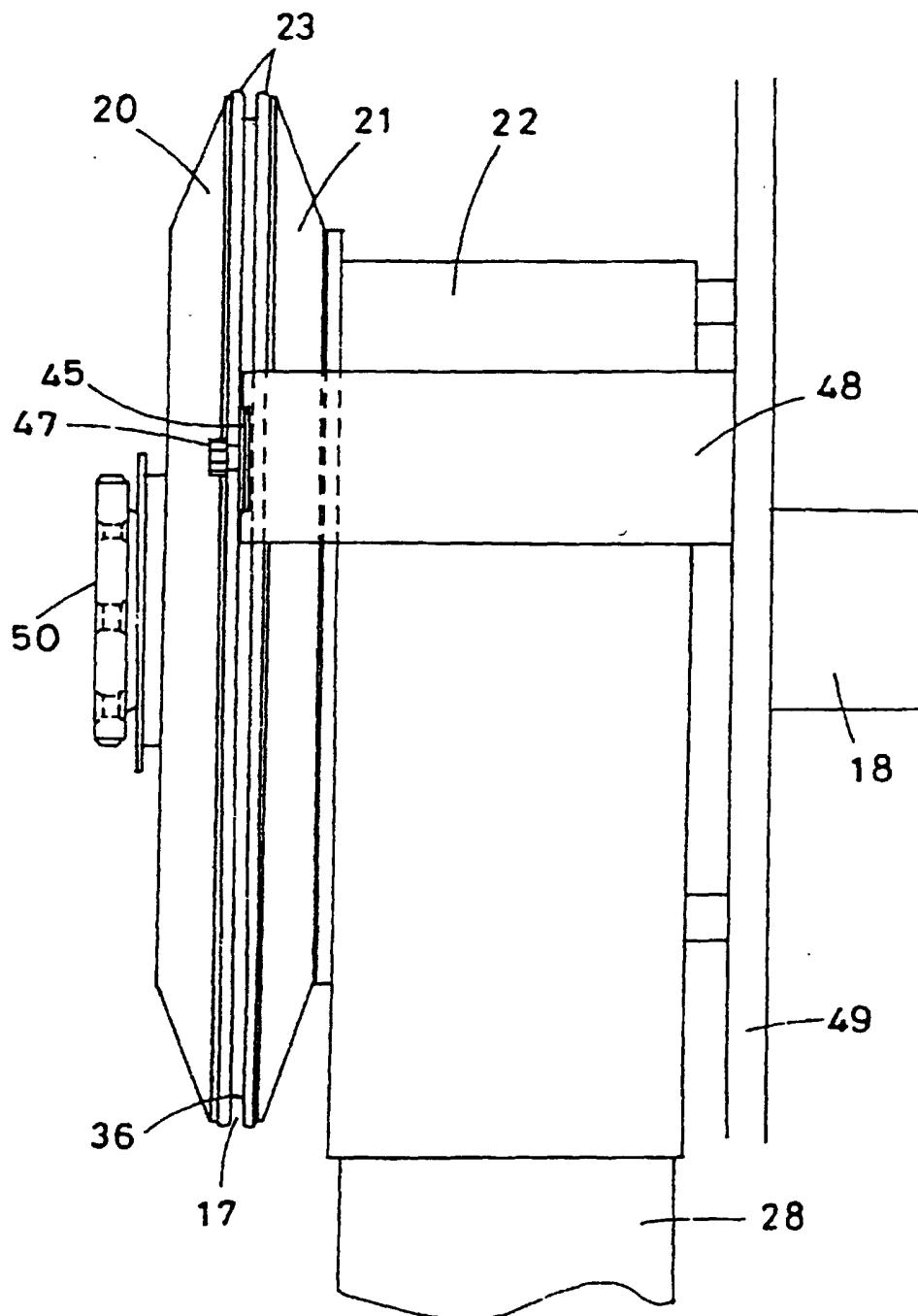


Fig. 6

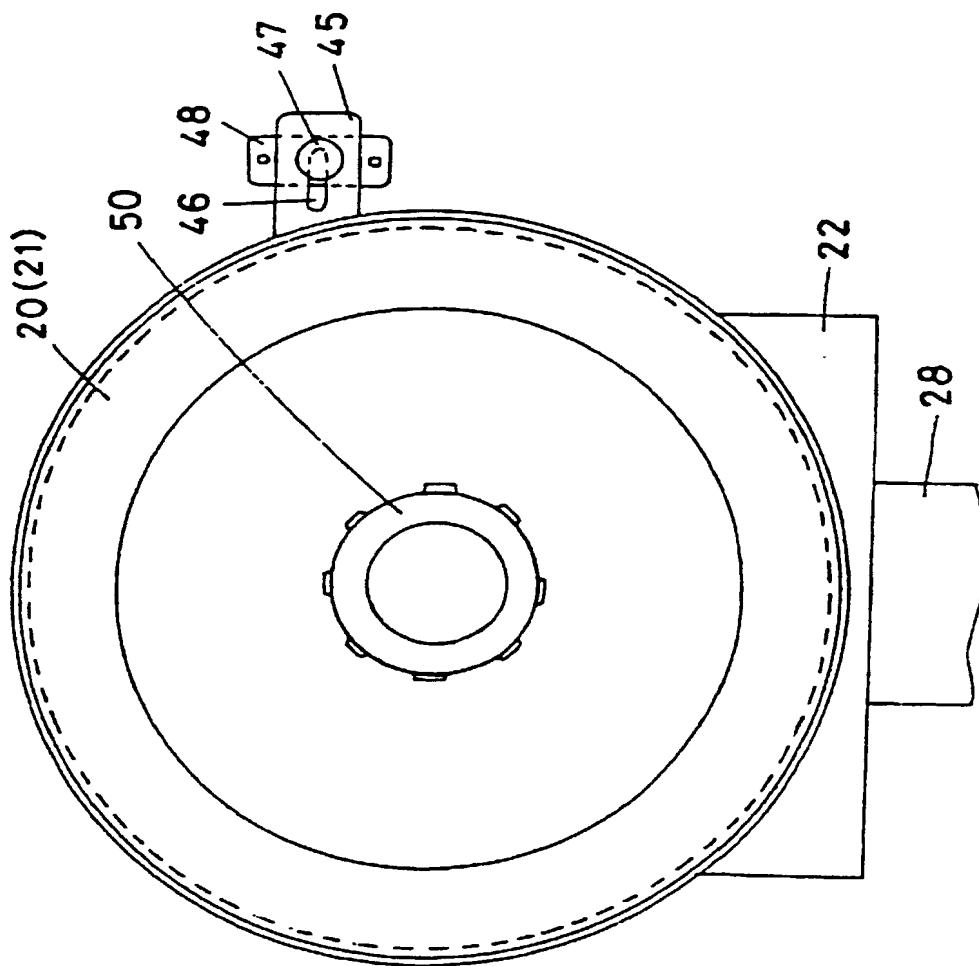
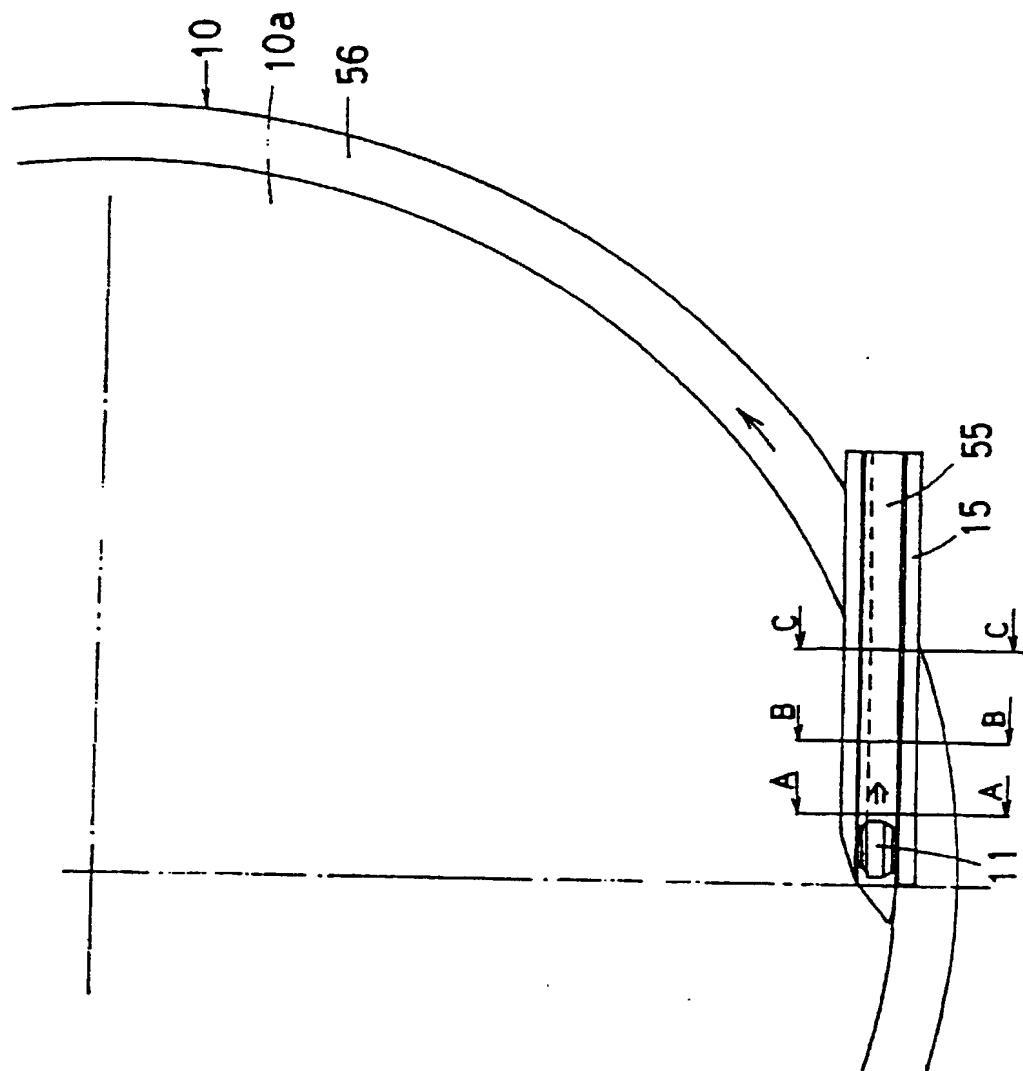


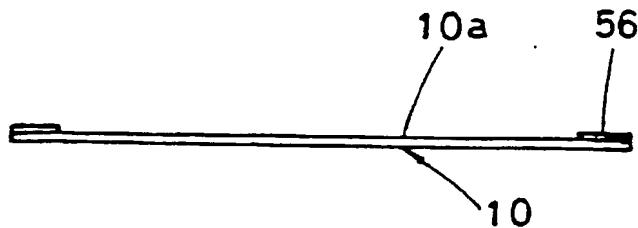
Fig. 7



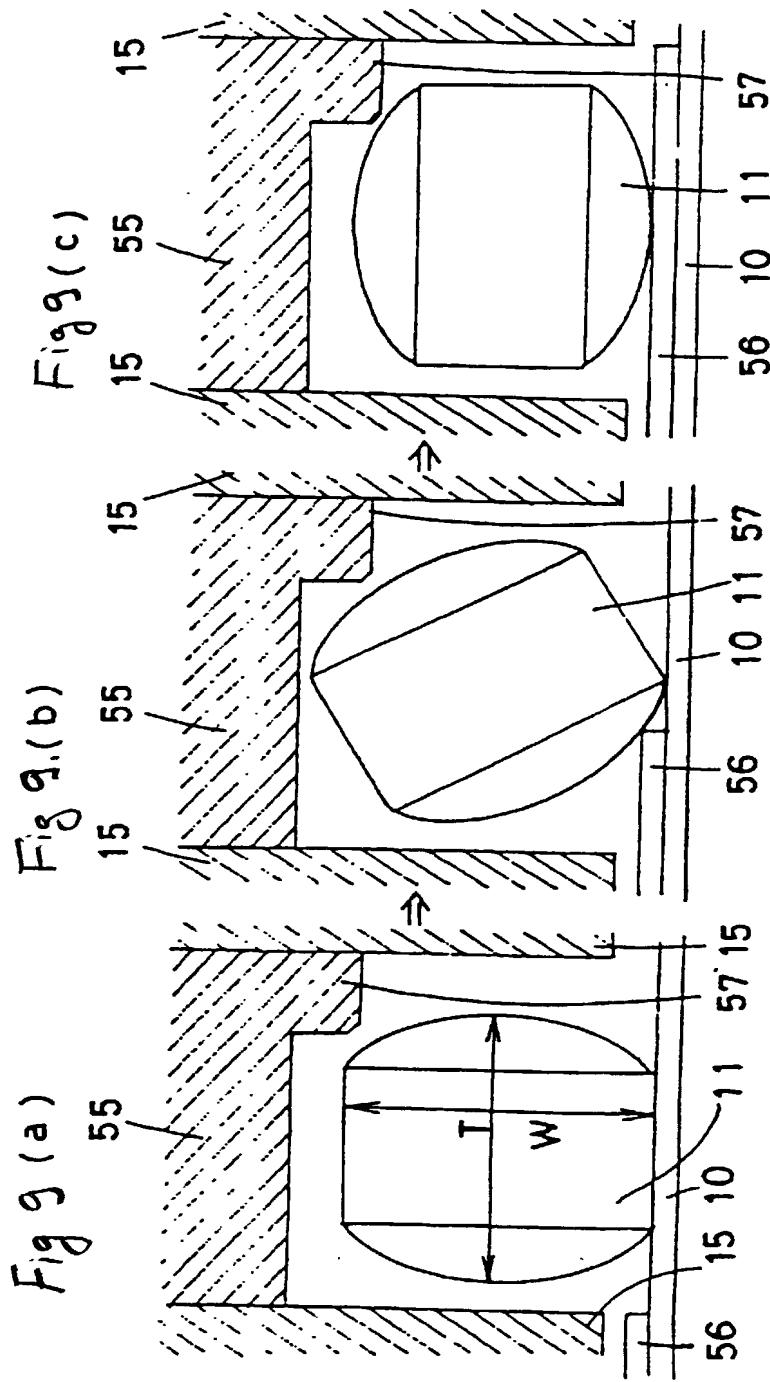
Hogan & Hartson 81833.0036
Shogo KAKIUCHI et al.
Conveying Apparatus, Inspecting
Apparatus and Aligning and ...
10 Drawing Sheets; Sheet 8 of 10

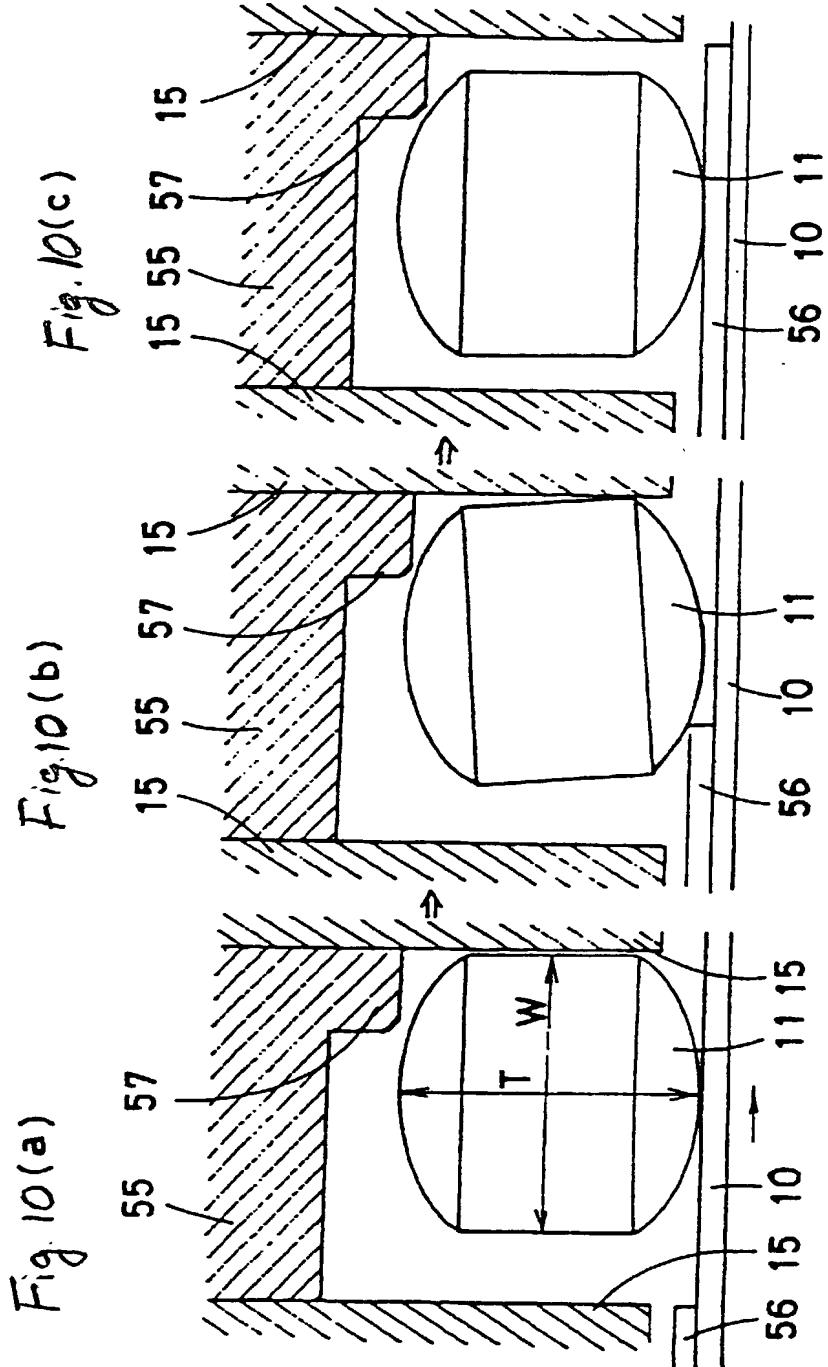
10/089598

Fig. 8



10/089598





DECLARATION
and POWER OF ATTORNEY

ORIGINAL
 CONTINUATION
 DIVISIONAL

As a below named Inventor, I declare that the information given herein is true, that I believe that I am the original, first and sole Inventor (if only one name is listed as 1 below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: CONVEYING APPARATUS, INSPECTING APPARATUS AND ALIGNING AND SUPPLYING APPARATUS, the specification of which is attached hereto unless the following box is checked:

was filed on _____ as United States Application Number or PCT International Application Number _____.

My residence, post office address and citizenship are as stated below next to my name.

I acknowledge my duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations § 1.56(a). I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

COUNTRY	APPLICATION NUMBER	DATE OF FILING Month Day Year	PRIORITY CLAIMED UNDER 35 U.S.C. 119
Japan	11-278585	September 30, 1999	Yes

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/JP00/08758

September 29, 2000

Pending

(Application Serial No.)

(Filing Date)

(Status)

POWER OF ATTORNEY: As a named Inventor, I hereby appoint the following attorney(s) and/or Agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. Customer Number **000026021** →



26021

PATENT TRADEMARK OFFICE

Hogan & Hartson L.L.P.
500 South Grand Avenue, Suite 1900
Los Angeles, California 90071

DIRECT TELEPHONE CALLS TO:
Michael Crapenhoff
213-337-6700

Send correspondence to:

 Customer Number **000026021**

(Please Print)

1	Name of Inventor Shogo KAKIUCHI	Residence: CITY Kobe-shi, Hyogo JPX	STATE or COUNTRY Japan
2	Post Office Address Room 202, Bell Fore Mori, 4-5, Moriminami-machi 3-chome, Higashinada-ku, Kobe-shi, Hyogo 658-0011 Japan		CITIZENSHIP Japanese
3	Name of Inventor Koji TSUTSUMI	Residence: CITY Kawanishi-shi, Hyogo JPX	STATE or COUNTRY Japan
4	Post Office Address 2-7-108, Terahata 2-chome, Kawanishi-shi, Hyogo 666-0034 Japan		CITIZENSHIP Japanese
	Name of Inventor	Residence: CITY	STATE or COUNTRY
	Post Office Address		CITIZENSHIP
	Name of Inventor	Residence: CITY	STATE or COUNTRY
	Post Office Address		CITIZENSHIP

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 1 <i>S. Kakiuchi</i>	SIGNATURE OF INVENTOR 2 <i>K. Tsurumi</i>
DATE Mar. 26, 2002	DATE Apr. 1, 2002
SIGNATURE OF INVENTOR 3	SIGNATURE OF INVENTOR 4
DATE	DATE